

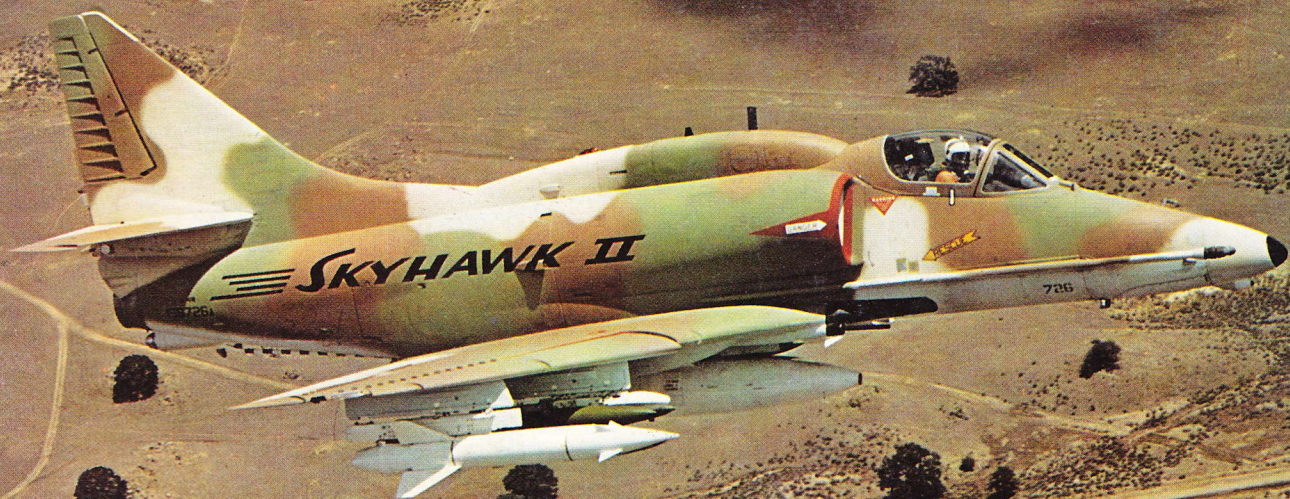
October 1973

IAN ALLAN

20p

aircraft

ILLUSTRATED



AIRFIX NEWCOMERS

1/24th scale HURRICANE Mk 1.

During the Second World War the Hawker Hurricane, powered by a Rolls Royce Merlin III engine, proved to be one of the toughest and most reliable fighter aircraft in service. Now you can build it with a great new 1/24th scale Airfix kit.



POLISH LANCER.

This 54mm figure is of a lancer of the 1st Squadron of the Old Guard who shared Napoleon's exile with him at Elba.

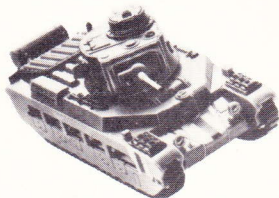


FRENCH GUARD.

This French Grenadier belonged to the 1st Regiment of Foot Guards formed in 1804, and makes a beautifully detailed 54mm model.

MOSKVA.

This Russian anti-submarine warfare helicopter carrier—maximum speed 30 knots—came into service in 1968. She has provision for 30 helicopters.



The world's biggest range of construction kits



Armaments:
4 20mm Hispano
or Oerlikon guns

Engine: Rolls Royce Merlin XX 1260HP
Speed - 329 MPH at 18,000ft.

Span: 40'
Length: 32' 3"

**HAWKER
HURRICANE 11C
1-72nd SCALE KIT**

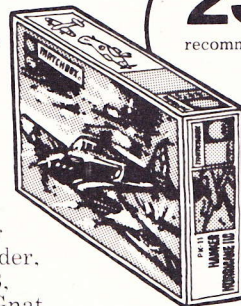
New from **"MATCHBOX"** Super-fine detailed aero models

This "MATCHBOX" kit contains a choice of two decals - those of R.A.F. No. 87 (Night Fighter) Squadron which specialised in night fighter intruder operations against such airfields as Caen in occupied France - and No. 3 (Fighter) Squadron R.A.F.

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The Hawker Hurricane is one of a whole range of finely detailed aero models from "MATCHBOX": Hawker Fury, Spitfire Mk. 1X, Boeing P-12, Zero Alpha Jet, Lysander, Gladiator, Huey-Cobra, Strikemaster, Focke-Wulf 190A-3, Northrop F5-A, Mustang P51-D, Corsair F4U-4, Folland Gnat.



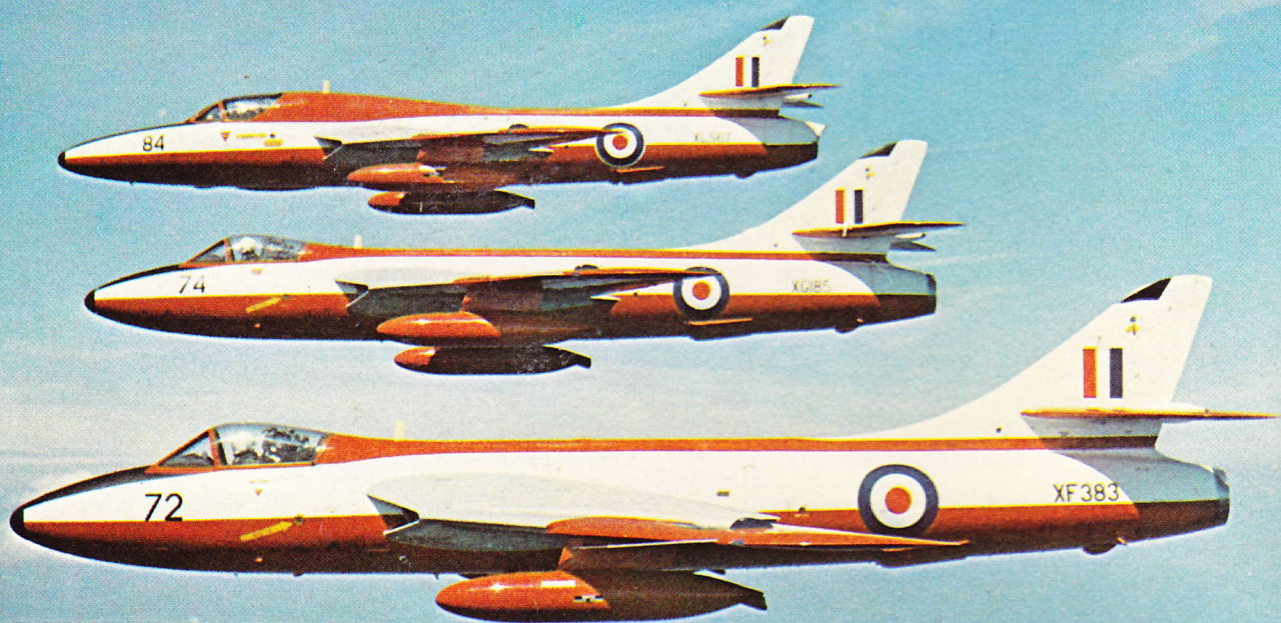
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	389	News & Views
James D. Oughton	394	Liberator—introduction to war
	400	The versatile Skyhawk
Kenneth Meehan	402	New Zealand agricultural Tiger Moths
	404	The hardware revolution
Alan J. Wright	407	British Civil Aircraft Register
photo feature	408	Flying colours
James Goulding	410	Modelling World
	412	Arrested at Bedford
	414	The Blackburn Shark
Robert Jackson	416	Shooting Star at war
Derek N. James	419	The Boulton Paul P.92 & P.92/2
photo feature	423	Photofile
Peter R. March	424	Airview
	428	Books

NEXT MONTH

The Sopwith sequence—an outline history of the famous Kingston-on-Thames based aircraft constructor and its line of thoroughbreds.



Cover: The McDonnell Douglas A-4N Skyhawk II single-seat light attack bomber.

Frontispiece: Two Hunter F.6s and a Hunter T.7 of 3 Sqn, 4 FTS, on a recent sortie from RAF Valley, Anglesey.

Air Visual

PHOTOGRAPHIC COMPETITION

AIRCRAFT ILLUSTRATED is sponsoring a photographic competition for amateur photographers. The simple conditions of entry are given below. There is no entrance fee.

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The following prizes will be awarded:

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2. 35mm transparencies must be mounted and all transparencies preferably should be in transparency envelopes for protection. Competitor's name and full address together with photo caption to be written on the back of each print submitted, or attached to each transparency or transparency envelope.
3. A stamped addressed envelope to be enclosed for the return of unsuccessful entries.
4. The winning entries may be published in AIRCRAFT ILLUSTRATED.
5. Ian Allan Ltd may acquire at its discretion and at an agreed fee copyright of reproduction rights in all entries.
6. Entries to be addressed to "Photo Competition", c/o Editor, AIRCRAFT ILLUSTRATED, Ian Allan Ltd, Terminal House, Shepperton, TW17 8AS.
7. The judges are the Editor and designers of AIRCRAFT ILLUSTRATED. Their decision is final and no correspondence can be entered into concerning it.
8. Whilst every care will be taken AIRCRAFT ILLUSTRATED cannot be held responsible for loss or damage.

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PUBLISHED BY

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TERMINAL HOUSE SHEPPERTON TW17 8AS-ENGLAND
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NEWS&VIEWS

Go-ahead for HS146

The Government is to invest £46m in the Hawker Siddeley HS146 short haul airliner project which is due to fly in January 1976 and enter service in 1977. Hawker Siddeley will invest £40m of its own money in the project and the Government has written into the contract the safeguard that should the development cost of the aircraft escalate Hawker Siddeley will have to pay the difference. Making the announcement, the Aerospace Minister, Mr Michael Heseltine, said he was satisfied that HSA had the financial resources to undertake the project on these terms. The HS146 will be powered by four American-built AVCO-Lycoming 502 turboprops and the standard model will seat 71 passengers, while a six-abreast version will accommodate 88. There are also plans to increase its capacity to 102.

Tanzania buys HS748

The Government of the United Republic of Tanzania has bought a Hawker Siddeley 748 for executive and VIP transport. The aircraft will be supplied in a 36 executive seat configuration which can be changed quickly to incorporate a VIP compartment and an 18 executive layout. The aircraft was chosen after an exhaustive evaluation of comparable aircraft by the Tanzanian Government, which included a week's demonstration by the 748 in Tanzania—flying from airfields which normally are not used by aircraft of this size.

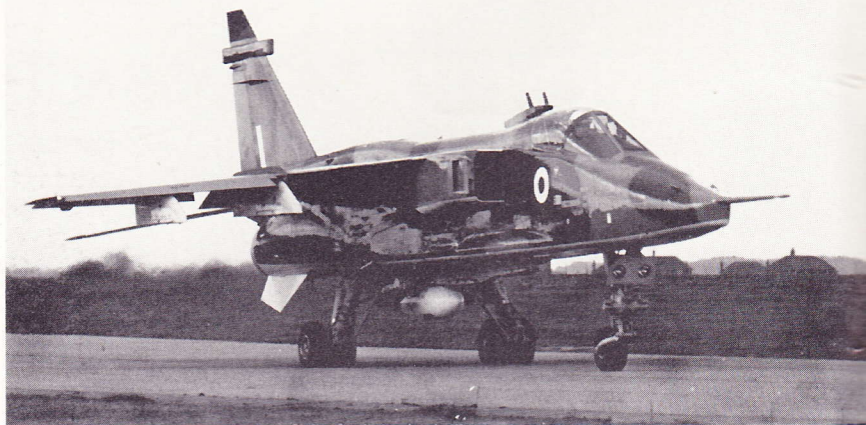
Tanzania becomes the seventh Afri-

Top to bottom: Vulcans are now being fitted with a new radar warning equipment, the presence of which is revealed by an oblong antenna at the top of the tailplane.

Prototype Jaguar S.07 carrying a practice bomb carrier on the rear station of the under-fuselage pylon. A colour photo of this machine appears on page 405.

The Harrier aerodynamic test aircraft XV277 is currently being flown with a representative Sea Harrier radome, which replaces the normal camera nose installation. Protrusion on leading edge of fin is believed to house passive radar warning equipment similar to that installed in the tactical strike Jaguar and Vulcan.

First Advanced 727 with maximum gross weight of 208 000lb made its first flight in August from Boeing Field, Seattle, in the red and white colours of Denmark's Sterling Airways which has ordered three of the trijets.



can operator of the HS 748 of which 275 have been sold and are in service with 57 operators in countries around the world.

Third B.747B for TAP

Transportes Aereos Portugueses (TAP), the Portuguese national airline, has placed an order for its third Boeing 747B. Delivery is scheduled for June 1974.

Saudia buys B.707s

Saudia, Saudi Arabian Airlines, has bought two Boeing 707-320Cs from World Airways. The aircraft were scheduled for delivery in August. The deliveries will bring Saudia's B.707 fleet up to four. The remainder of the company's fleet comprises two B.720Bs, five B.737s, six Convair 340s and six DC-3s. Two B.737s are scheduled for delivery in May and June 1974.

Singapore Airlines orders third B.747

Singapore Airlines has ordered a third B.747-200B which will go into service in October 1974. SIA's first two B.747s were due to arrive in September and will enter service on October 1.

Two more 747Bs for Qantas

Qantas has received Australian Government approval to purchase two more Boeing 747Bs. The two aircraft will go into service in March and May 1974 bringing the airline's superjet fleet to eight. They will be identical to those in the airline's present fleet except for higher-power engines, automatic braking system and a third galley unit to improve cabin service to economy passengers.

The Qantas order brings the number of 747s ordered by 35 airlines and the US Air Force to 237, of which 215 have been delivered.

Harriers for Spain

The US Government has extended its AV-8 Harrier contract with Hawker Siddeley to include eight additional airframes for supply to Spain for use on the carrier *Delado*. There may be further contracts at a later date bringing total orders from Spain to 24. The basic airframes will be built by HSA and shipped with engines to the USA where electronics, radio/nav attack systems and weapons will be fitted before supply to Spain. Crews will be trained in the US. Spain went to the US partly due to political problems with Britain and also because a

navalised Harrier existed with the USMC in the AV-8. The demonstration by a Hawker Siddeley test pilot of a British Harrier on *Delado* last November clinched the Spanish decision.

It's the Hawk

The "Hawk" has been selected as the name for Hawker Siddeley Aviation's new HS 1182 two-seat jet training aircraft. The Hawk is expected to make its first flight next spring and is scheduled to enter RAF service towards the end of 1976. The new aircraft will initially replace the Gnats of RAF Training Command flying in the advanced training role, and will eventually undertake additional jet flying training commitments including the weapon training role in which the aircraft will replace the Hunters presently used.

The Hawk is powered by a single Rolls-Royce (1971)/Turbomeca Ltd un-reheated (RT 172-06) Adour turbofan powerplant. Surveys carried out by Hawker Siddeley indicate that there is a market for several thousand aircraft to replace existing basic and advanced trainers, and also provide a ground attack or close-support capability. The Hawk is expected to capture a significant share of the market.

It will be available for overseas markets following initial deliveries to the RAF.

Spey engine hushkits

Rolls-Royce is now working with four airframe companies to quieten all types of Spey-powered commercial aircraft—the BAC One-Eleven, Fokker F.28 Fellowship and Hawker Siddeley Trident airliners and the Grumman Gulfstream 2 executive aircraft. These programmes cover the development of Spey engine hushkits for flight testing to evaluate their effectiveness. The hushkits are intended to reduce the noise of nearly every version of these aircraft to levels which meet the expected noise regulations for existing aircraft in the late 1970s and early 1980s. The Fokker F.28 Fellowship already meets the FAR 36 requirement of the US Federal Aviation Administration without the use of a hushkit, but Rolls-Royce and Fokker are engaged in a continuing programme directed at further quietening of the aircraft.

A Fokker F.28 Fellowship with Spey hushkits was flight tested recently. Hushkit testing on a Grumman Gulfstream 2 will begin later this year and flight tests on a BAC One-Eleven and Hawker Siddeley Trident are scheduled for early 1974. These tests are a logical extension of earlier Rolls-Royce pro-

grammes to study Spey noise reduction.

A complete Spey hushkit consists of noise-absorbent linings in the engine intake, in the bypass duct and in the jetpipe as well as a silencing nozzle at the rear of the engine. Kits are designed to quieten Spey engines at minimum weight penalty and effect on costs and engine performance.

Compass Cope RPV crashes

The USAF's largest remotely piloted vehicle (RPV), the Boeing-built Compass Cope prototype, crashed whilst landing at Edwards AFB, California, on August 4. The aircraft had made a successful first flight on July 28 when it flew for one hour and attained an altitude of 10 000ft. The Compass Cope RPV differs from earlier RPVs in that it is designed to be landed rather than recovered by parachute. The aircraft is 40ft long and 13ft high at the HE J97 turbojet engine which is pod-mounted on top of the fuselage.

Boeing was awarded a contract in July 1971 to develop two prototypes. The state of advancement of the second prototype is not yet known.

Teledyne Ryan also has a contract for the construction of two Compass Cope prototypes. The first flight of the No 1 vehicle is not expected to take place before next year.

Another Hunter squadron formed

To provide future Jaguar pilots with experience of high-speed ground attack techniques, a second Hunter squadron has been formed at Wittering. No 58 Squadron formed there on August 1 as a result of the splitting of 45 Squadron.

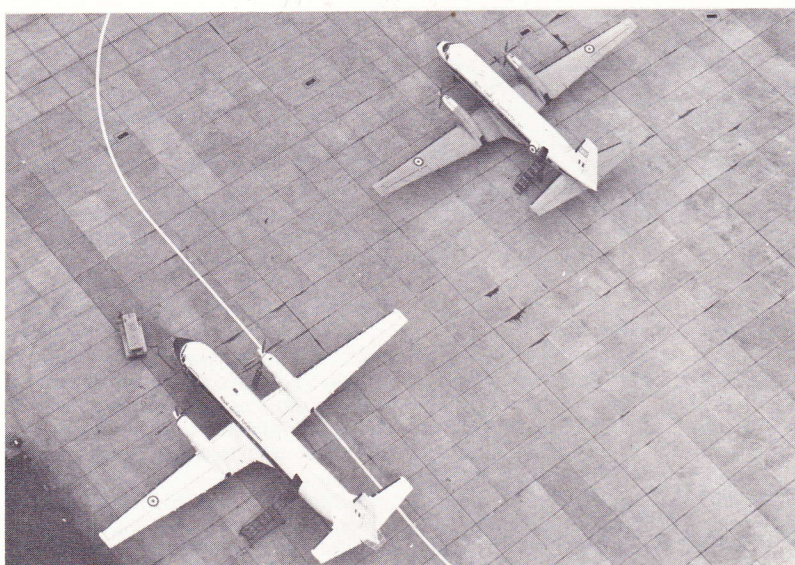
Both squadrons will concentrate on operational training and will also take part in exercises. They will not be assigned to NATO or given any formal war role, although they may be of operational value in certain circumstances.

"Blue Angels" setback

Following the loss of two F-4J Phantom IIs of the US Navy's *Blue Angels* precision flight demonstration team in a mid-air collision while practising for an air show in the USA on July 28, the remainder of this year's appearances by the team were cancelled. This latest crash, in which two pilots and one enlisted aircrewman were killed, brought the total of *Blue Angels* machines lost this year to six.

Advanced B.727 first flight

The first Boeing Advanced 727 with maximum gross weight of 208 000lb



Top: The task of changing the name on the fuselage of BEA aircraft to British Airways is now well under way, this Trident Three, seen early in August, being one of the first to be repainted. The job of changing liveries will begin in November.

Above: The BLEU's Andover XS606 and HS748 XW750 are now engaged in a Government-funded R/STOL research programme. The programme is providing useful aerodynamic and operational information for use as guidelines in the design of future aircraft. *RAE*

flew for the first time on July 26. The aircraft, destined for Denmark's Sterling Airways, landed at Boeing Field after a two hour, four minute flight. Sterling, world's largest charter operator, ordered three of the modern trijets in February 1972, and holds options on two more. First delivery will be in November following flight test programme and FAA certification. Increased weight, including additional fuel, will give Sterling improved payload/range capability such as non-stop Scandinavia-Canary Islands, more than 2 500nm with 189 passengers.

Another Lancaster for Scampton

Lancaster NX611 which has from some years languished at Squires Gate, Blackpool, has been formally handed

over by its owner, Lord Lilford, to RAF Scampton, Lincs, where, after refurbishment, it will stand outside the base's main gate, replacing "Q-Queenie" now in the RAF Museum at Hendon. NX611 is now beyond active flying but it will be restored and repainted in "authentic" RAF WWII colours.

700th DC-9 produced . . .

The 700th DC-9 twin-jet transport to roll off the assembly line at the Douglas Aircraft Company division of McDonnell Douglas Corporation was delivered on July 27. The aircraft is a C-9B military version of the commercial transport, built for the US Navy. The production milestone was reached in less than eight years after the first DC-9 delivery in September 1965. A total of 761 DC-9s has been ordered to date.

. . . and 100th DC-10 delivered

Western Air Lines accepted a McDonnell Douglas DC-10 on July 25, marking the delivery of the 100th DC-10 powered by General Electric CF6 turbofan engines. McDonnell Douglas has delivered three versions of GE-powered tri-jets: the Series 10 powered by the CF6-6 rated at 40 000lb; the Series 30 powered by the CF6-50 rated at 49 000 to 51 000lb; and the Series 30 convertible freighter, also using the CF6-50. CF6 engines have accumulated more than 700 000 engine flight hours.

ABC helicopter flies

The first of two Sikorsky S-69 Advancing Blade Concept (ABC) test helicopters made its maiden flight on July 26. The S-69, which has been given



the US Army designation XH-59A, uses a new rotor system requiring no tail rotor. The first flight, which consisted of low altitude hovering, lasted about 30 minutes during which an altitude of between 25 and 30ft was attained. The first prototype is powered by a UACLT PT6T-3 Turbo "Twin Pac", but the second machine, now nearing completion at Stratford, Conn, is tentatively scheduled to have two additional P&W J60 turbojets for auxiliary thrust for high speed flight of up to 300kt.

Cook Islands Airways formed

Plans to establish the first domestic airline in the Cook Islands were announced on August 6, by Air New Zealand and the Cook Islands Government. The first aircraft of Cook Islands Airways will be a nine-passenger Britten-Norman Islander and service will begin in November between Rarotonga, the main island of the Cooks group, and Aitutaki, about 160 miles to the north. Aitutaki eventually will be developed as a resort island. Air New Zealand will inaugurate DC-8 service to the Cook Islands in December, a month after Cook Islands Airways begins operation.

MiG-25 sets three world records

Three new world air records have been set by test pilot Hero of the Soviet Union Alexander Fedotov. Flying a MiG-25 (Foxbat) single-seat fighter he climbed to an altitude of 36 240 metres, an absolute world record for altitude. Two other records were registered by the instruments when the MiG-25 climbed to an altitude of

35 200 metres, 5 000 metres more than the ceiling of Fedotov's 1967 record. All three results are higher than the official world records. Fedotov developed a speed of 3 300km per hour in preliminary flights, but the registered speed was 3 100km per hour.

First European sale of MU-2J

The first European sale of the Mitsubishi MU-2J has been made to Mr Dennis de Ferranti for delivery in March 1974. The sale was made by the UK and Southern Ireland distributor, Express Aviation Services, Ltd, working in conjunction with Dismore Aviation, Ltd. The aircraft will be registered in Ireland.

The MU-2J is the latest long model of the Mitsubishi twin turboprop executive aircraft series. More than 250 MU-2s of all models have been sold to date.

400th Orion delivered

The 400th P-3 Orion anti-submarine warfare (ASW) patrol aircraft to come off Lockheed's production line at Burbank was delivered to the US Navy on July 30. According to Rear Admiral Herbert S. Ainsworth, Commander, Patrol Wings, Pacific, who accepted the aircraft, the P-3 will probably remain in production until the 1980s. In addition to the US Navy, the P-3 is in service with four other countries of the free world. Ainsworth, who commands the 11 P-3 patrol squadrons assigned to the Pacific, said he considers the C model of the Orion series to be the finest ASW system in the world. Since 1959, Lockheed has delivered 157 P-3As, 144 P-3Bs, 98 P-3Cs including the aircraft delivered on July 30 and one RP-3D, the Project Magnet aircraft used by the US Navy to map the earth's magnetic field.

Beech and Grumman discussing possible merger

The Grumman Corporation and Beech Aircraft Corporation, have begun negotiations looking toward a possible merger. The two aerospace companies complement each other. Historically and today the Grumman organisation is overwhelmingly a designer and builder of military aircraft—primarily for the US Navy. Beech Aircraft Corporation, on the other hand, is primarily a designer and builder of propeller-driven aircraft, sold chiefly for business and private use.

Mrs Olive Beech, chairman of Beech Aircraft Corporation, said that the merger under consideration could give Beech stockholders an increased divi-

dend rate coupled with the benefits of a broader product line in the aerospace, cryogenics, and general aviation fields. In addition Grumman now has developing interests in such activities as pollution control, health systems, leisure time products and data processing.

X-24B lifting body air-launched

The X-24B with John A. Manke, project pilot for NASA's Flight Research Centre at the controls, was air launched for the first time on August 1, from a B-52 flying at 40 000ft, and glided to a landing on the dry lakebed at Edwards AFB, California, four minutes later. The X-24B is the latest in a series of wingless lifting bodies to demonstrate the ability to manoeuvre and safely land a vehicle with a shape primarily designed for space flight. Its configuration is also representative of advanced aircraft of the future which would be capable of sustained cruise flight at hypersonic 3 500mph speeds.

Farnborough International '74

The Society of British Aerospace Companies, which earlier this year announced the Industry's decision to open the 1974 Farnborough Exhibition and Flying Display (September 2-8) to the world's aerospace companies, has now revealed plans for the main public days, together with admission charges. Farnborough International '74, as the show is to be known, will also break new ground in introducing public admission on the last of the Trade Days, Thursday, September 5. This will be the first time that the general public has had the opportunity to see the Farnborough Air Show operating commercially as a trade shop window for aerospace manufacturers, with the emphasis that day on the normal afternoon trade flying programme.

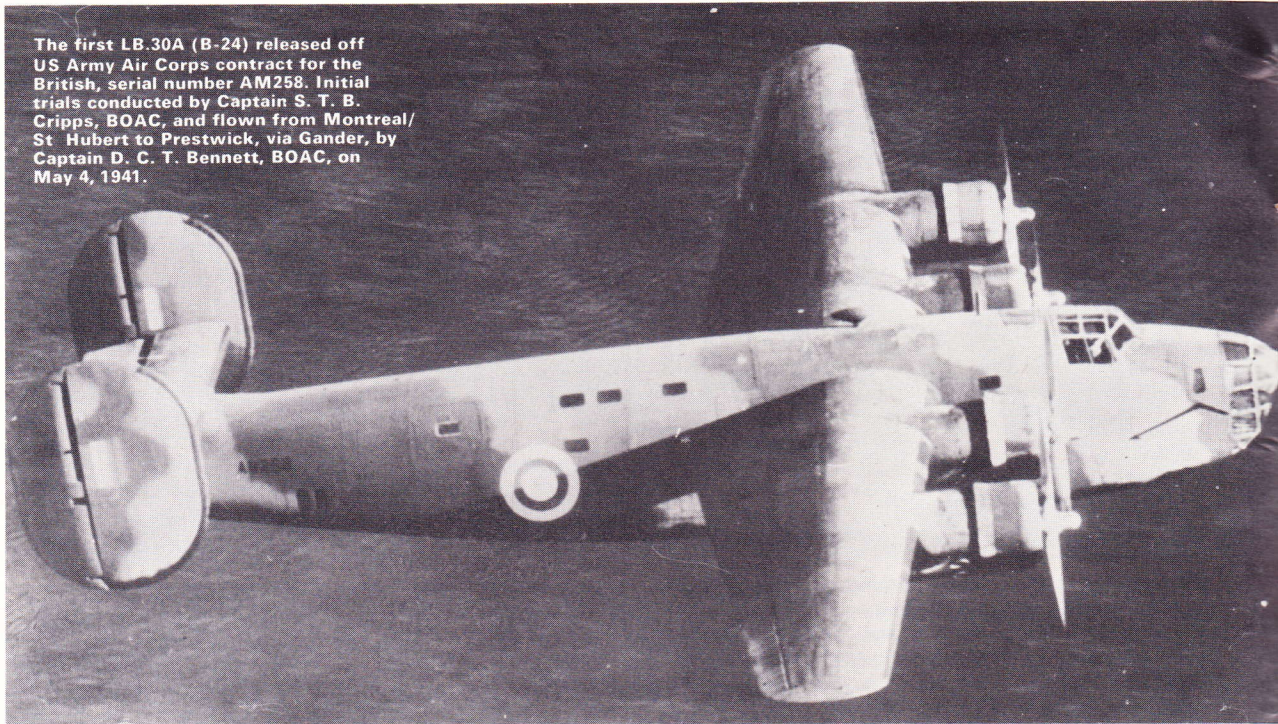
Admission charges on the Trade and Public Day, which are similar for both sectors, will be as follows:

Thursday, September 5. Adult or Child—£1.75, Cars £1.50, Coaches £2, Motor Cycles 50p and Grandstand £1.

Friday, September 6, will be the Public Premiere when an expanded flying programme will be introduced, incorporating special items of public appeal. Admission charges will be: Adults £2, Child 70p, Cars £1.50 additional, Coaches £2, Motor Cycles 50p, and Grandstand £1.

As in previous years, admission rates are reduced for the Main Public Days, Saturday and Sunday, September 7 and 8. These will be as follows: Adults £1, Child 60p, Cars £1 additional, Coaches £2, Motor Cycles 50p, and Grandstand £1.

The first LB.30A (B-24) released off US Army Air Corps contract for the British, serial number AM258. Initial trials conducted by Captain S. T. B. Cripps, BOAC, and flown from Montreal/St. Hubert to Prestwick, via Gander, by Captain D. C. T. Bennett, BOAC, on May 4, 1941.



AFTER Adolf Hitler had become Chancellor of Germany in 1933, British and French rearmament policies—especially in air power—were adjusted in direct relationship to his sabre-rattling gestures and, of course, his efforts to reinforce and expand the German state.

March 1935 brought the first direct reaction from the British—Hitler denounced the limitations of the Versailles Treaty and proclaimed conscription for a target peacetime army of 36 divisions; the formation of the new *Luftwaffe* was announced with the statement that it was already as strong as the Royal Air Force. In the previous year the British Air Ministry had called up two high performance interceptor fighters—later to achieve fame as the Hurricane and Spitfire; now the retaliatory power of the RAF was to be strengthened and work on Specification B 1/35 (demanding a heavier and more potent bomber than had hitherto been contemplated)—already circulated to the industry before Hitler's speech—was intensified, the contract going to Vickers.

But hardly had the British and French air re-armament plans begun to creak into action when Hitler staged his first overt military manoeuvre and occupied the demilitarised zone of the Rhineland in March 1936. As a direct result of this action, the Air Ministry formulated two new requirements—B 12/36 and

LIBERATOR

Introduction to War

James D. Oughton



P.13/36—the first of which called for the heaviest bomber yet envisaged for the RAF, four-engined and with a radius of action of more than 1 000 miles. The second specification set out requirements for another new class of “medium-heavy” bomber with two engines in the 2 000 horsepower class. The big bomber prototype contracts were placed with Shorts and Supermarine, and the P.13/36 con-

tracts with Avro and Handley Page. The initial phases of design investigation demonstrated the great improvement of the 1936 aircraft over the B.1/35 (Warwick) and in consequence the latter fell from favour and the programme was allowed to slow down.

But Hitler showed no signs of slowing down—he concluded the Axis pact with Mussolini in October 1936, signed the Anti-Comintern pact

Below left: AM259, the first Liberator to reach England, flown by David Waghorn and Maurice Summers from Montreal via Gander to Squires Gate. The aircraft is seen after landing at Squires Gate on March 14, 1941, with the two pilots standing in front of the nose.

Below: The first LB.30A in May 1941 with its original serial number (AM259) supplanted by the civil registration G-AGCD. Tests for a C of A (granted on May 15) were carried out by Captain J. H. Orrell, BOAC, and it was during the course of these tests that the aircraft was found to be unsuitable for the Scandinavian service of the Ministry of Economic Warfare, for which purpose it had been registered.



with Japan the next month and in January 1937 made a speech in which he repudiated all the limitations of the Versailles Treaty. It was in this year—1937—which had started off with the scarcely-veiled threats from Nazi Germany, that the first real problems arose in the new bomber programme for the RAF. The engine inherent in the P.13/36 requirements—the Rolls-Royce Vulture—was indicating severe development troubles and Rolls-Royce was already warning the Air Ministry that it would be a better solution to go to a four-Merlin powerplant. There were some difficulties also with the B.12/36 engines (Bristol Hercules) but in the event they came out broadly on programme. The engine problem was eventually resolved in the summer of 1937 by allowing the Avro P.13/16—the Manchester—to go ahead on a calculated risk basis retaining the two Vultures, while the Handley Page design—the Halifax—went ahead with four Merlins. (It is realised that the names for these designs were not current at the time but they have been used for the sake of simplicity).

In France during these sensitive years, the armed forces were—on paper—much to be reckoned with, but in fact were deplorably equipped for a “modern” war, especially in the air. The arrival, in January 1938, of a young and energetic Air Minister—

Guy La Chambre—brought some fresh impetus to air re-armament, but by March 1938 total French production was only some 40 aircraft per month, compared with about 250 by Germany.

And then the cold—or lukewarm—war began to heat up. The *Anschluss* results were announced on April 10 and Austria became part of the Third Reich; hardly had the dust settled when an even greater crisis arose over the Sudeten German question, and it seemed that Hitler was about to invade Czechoslovakia.

Real relationships between France and Great Britain at this time—April/

May, 1938—were not nearly so close as many imagined, and as the Sudeten/Czech crisis grew worse France suddenly found herself alone. The British Government, in May, told the French, in as many words, that the British would not support them in a joint military action to preserve Czechoslovakia if the Germans invaded. This blow was followed by an even stronger one from Poland, whose Government not only made a similar statement but emphasized that, should the French call on her other major ally—Russia—then the Poles would resist passage across their territory by force.

The French air force had few, if any, realistic ideas for strategic bombers—the Allied plans had been based largely on the new heavy bombers coming from Britain. But *La Chambre* had, in secret, taken out some insurance in the United States and in this crucial month of May 1938 the first French heavy bomber requirement was investigated at San Diego, California.

Initial approaches had been made to Boeing, whose XB-17 bomber had flown in July 1935, but its design and production facilities were under too great a pressure for extra work to be undertaken. The Consolidated Aircraft Corporation, on the other hand, had set a pattern of remarkably successful long range flying boats and welcomed the opportunity to study a large land-plane design.

The French requirement was investigated by Isaac M. Laddon, Vice-President and Chief Engineer, as a development of the then-new XPB2Y-1 four-engined flying boat (Consolidated Model 29) and a new Model number was allocated, with a prefix that underlined the breakaway from flying boats and which can best be seen in the list of designs current in 1938:

Model No	Military Designation	†Name
28	PBY	Catalina
29	PB2Y	Coronado
*LB.30	—	—
31	P4Y	Corregidor

*“LB” denoting “Land Bombardment”

†It is again recognised that the names quoted were not in fact adopted until later years.

The LB.30 as first studied was a shoulder-wing four-engined monoplane, similar in general layout to the Model 29 flying-boat in that it had twin fins and four Pratt & Whitney Twin Wasp engines. But, almost as soon as the Model 30 was schemed, a new and vitally important factor entered the design thinking.

A young aerodynamicist, David R. Davis, approached Major Reuben H. Fleet, President of Consolidated, with a proposal for a new aerofoil section, one of several patented in 1934, with very low profile drag coefficients. Laddon became interested and the new wing based on the Davis patents was first applied to the definitive LB.30 in June 1938, emerging as a high aspect ratio two-spar structure into which Laddon designed main integral fuel tanks at the centre section. But the tenuous nature of the French strategic bomber requirement led to the LB.30 design being temporarily shelved in favour of the interest shown by the US Navy in the Davis wing applied to a flying boat; the promise of a contract for this new boat seemed more firm and in consequence Consolidated began design and construction of the Model 31 twin-engined flying boat with authorisation dating from July 11, 1938.

The wing was essentially that envisaged for the Model 30, a 110-feet span two-spar structure containing Fowler flaps; it differed from the Model 30 in having mountings for two engines and also underwing floats which retracted to lie flat against the underside of the outer wing sections.

By the use of then-advanced lofting and other techniques, the Model 31 was built in record time and began engine runs on April 29, 1939, going on to make its first flight on May 5 that year.

But, returning to May 1938: the British had sent an Air Ministry mission to the USA and Canada, and although its first task was to make special purchases of reconnaissance (Lockheed Hudson) and training (North American Harvard) aircraft in the USA, there was a major proposal contained within its terms of reference to examine the war potential—nominally in Canada—of an aviation industry which could produce heavy bombers. This was followed by a second mission in July 1938 wherein the heavy bomber requirement was more clearly spelled out—200 bombers per year on a peacetime footing and 500 in the first year of war—with deliveries across the Atlantic by air.

The British bomber requirement centred on British designs being produced under licence and a contract was approved between the UK Government and the Canadian Associated Aircraft Co in November 1938 for a pilot programme of Hampdens to be followed by the mainstream production of Stirlings, which were to reach a production rate of 20 per month by the spring of 1942.

In the meantime a special French Air Mission, led by M. Jean Monnet, visited the USA in the winter of 1938-1939 and placed many orders, among them a tentative requirement for 100 Consolidated LB.30s, which type was being re-evaluated in the light of an impending requirement for a long range bomber by the US Army Air Corps.

By now the existence of the hitherto-secret involvement of the French Government with the US Industry in May 1938 was at least known in political circles, for M Daladier—the French Premier, announced in September 1938 that he had been warned by the US Government that its Neutrality Act would, even if war broke out, prevent delivery of the aircraft ordered by the French the previous May.

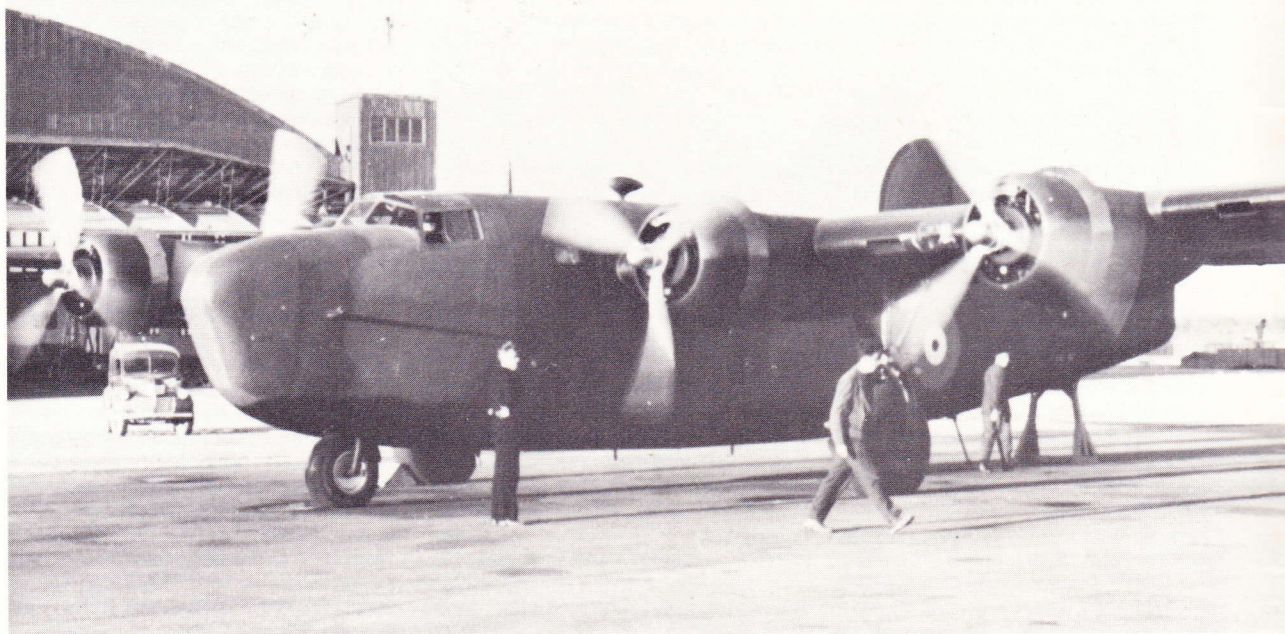
By this time the political problems were acute—the heat had, to an extent, gone out of the Czech crisis by May 23 when Hitler (after the Czechs had started mobilising) announced that he had no aggressive intentions towards Czechoslovakia. But on September 12 he made an inflammatory speech at Nuremberg and the second, and major, Munich crisis followed as Neville Chamberlain, the British Prime Minister, flew to Berchtesgaden (September 15), Godesberg (September 22) and finally Munich (September 29) in attempts to appease the German dictator.

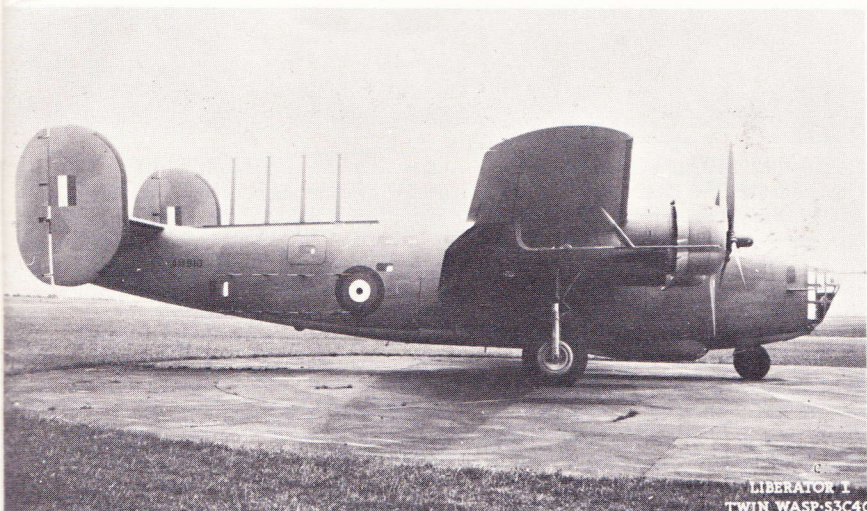
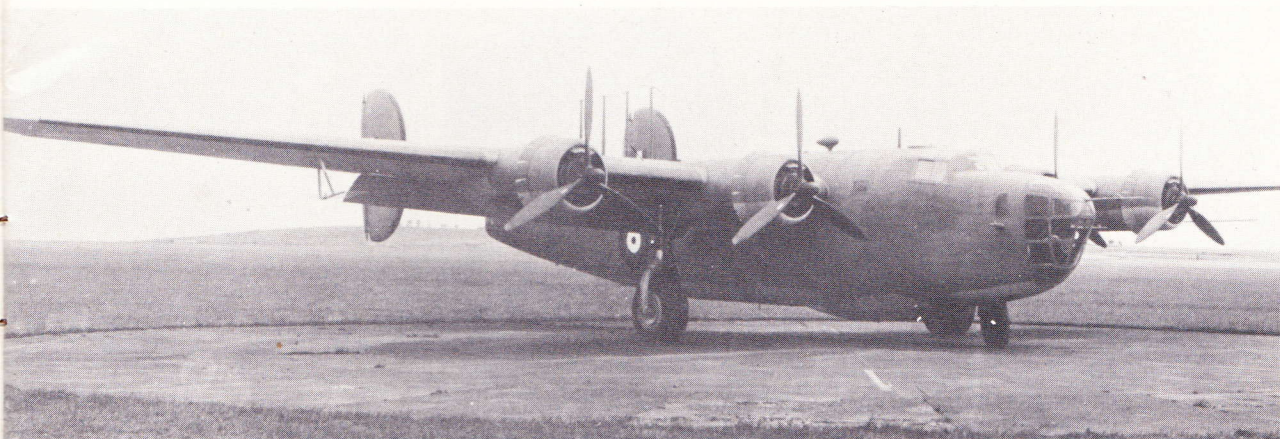
But the agreement drawn up at the end of the month ceded the Sudetenland to German and the German Army marched into Czechoslovakia on October 1, 1938.

These political manoeuvres had precipitated a telegram from the Air Ministry to the Air Attache in Washington calling for an urgent estimate of types and numbers of aircraft which could be bought in the USA for delivery in the UK within one month.

This was a panic measure which could obviously have brought little in terms of immediate useful results, but it is significant that the close links then obtaining between the Air Ministry and the USAAC brought mention of the latter's interest in Consolidated's new bomber.

In January 1939 this interest hardened up into a request for a design study to an Air Corps Specification under the bombardment sequence number B-24; Consolidated's design team applied the same drive and ability as they had shown with the Model 31 and within three months had built a mock-up of the new bomber developed from the LB.30 and now styled Model 32—the mock-up conference approved basic design and performance estimates and a contract was placed—on March 30—for a prototype, the XB-24. This was followed up the next month by the formal placing—on April 26—of a contract for a total of seven service test aircraft, designated YB-24. At the end of this month the Model 31 flying-boat began engine runs, and made its first flight on May 5. At this time the first British heavy bomber, the Stirling, made its first flight (on May 14) but this was an inauspicious occasion for the aircraft crashed on landing and was written off. This in no way altered the Air Ministry's faith in the design, for it was to press for the licence building of Stirlings both in Canada and the USA—in the latter case specifically at one time supplanting the production of B-24s—for some time to come.





Top & above: Two views of AM910, the first LB.30B (B-24A) Liberator Mk I, at the A & AEE, Boscombe Down, in July 1941. The aircraft has been fitted with ASV Mk II radar and under the forward bomb-bay, which has been sealed off, is a "pack" of four 20mm Hispano cannon. The modifications were carried out at Heston by a team of Handley Page and Heston Aircraft engineers and after the Boscombe trials were completed the aircraft was delivered to No. 120 Squadron at Nutts Corner.

Left: LB.30A No. AM262 about to leave Gander for Ayr with the Canadian Prime Minister, Mr W. L. Mackenzie-King, on board on August 19, 1941.



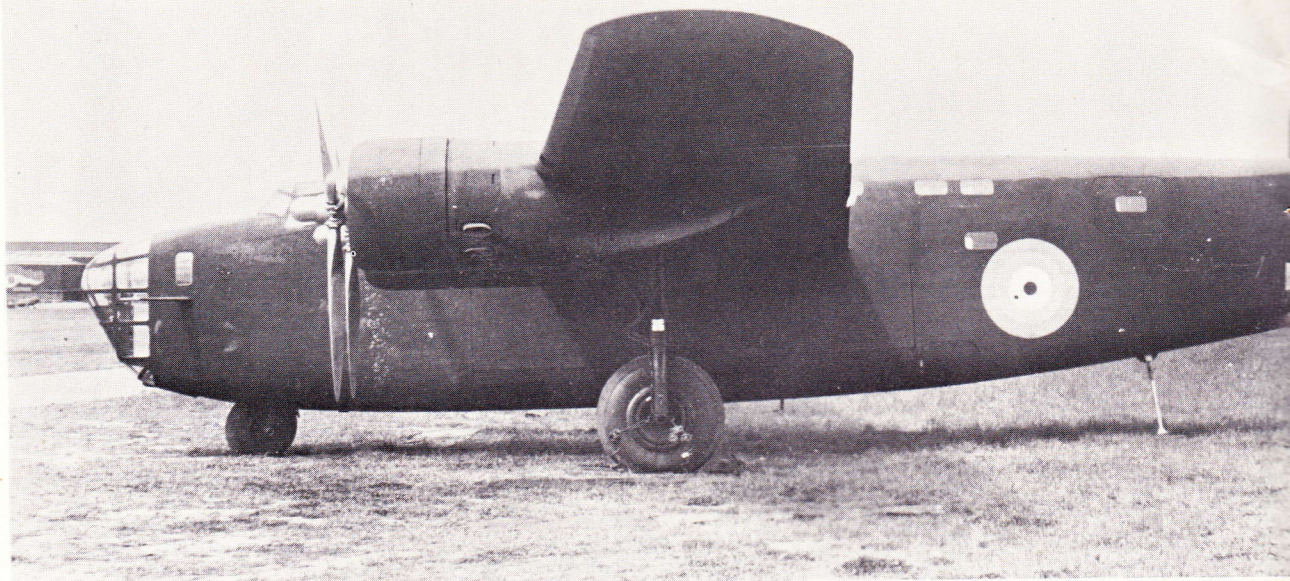
American aircraft to a total of 2 065 which included confirmation of their arrangements with Consolidated for a total of 139 LB.30s. British requirements were for Stirlings to be built under licence—and this was still being insisted upon as late as July 1940, with the Air Ministry openly declaring that the B-24 was inferior to the Stirling. However, by October 1940 it had changed its tune and stated that if a British bomber was to be produced in the USA then it must now be the Halifax, which had shown itself to be "immensely superior" to the Stirling. To say at this late date that the chances of the Americans building any British heavy bomber were slight is overstating the case—the B-17 was in full production and the XB-24 had made its first flight, successfully, on December 29, 1939.

This month—December 1939—had marked a disastrous bombing raid by RAF Wellingtons in which more than 54 per cent of the aircraft attacking were shot down, with others badly damaged. The need for armour, self-sealing tanks and better turrets had never been made more tragically obvious and was to hold back procurement and operational use of American aircraft which had been built without such operational necessities afforded the priorities they needed.

In October 1939 British and French Purchasing Commissions had been set up in Washington and with the repeal of the US arms embargo in November, supplies of armaments began to flow across the Atlantic. To some extent there was mutual agreement between the Allies but it appears that the LB.30 contract remained officially French until the German break-through at Sedan and the ensuing collapse of France led to the formal taking-over of French contracts in the USA by the British.

By now the outbreak of war in Europe was generally regarded as inevitable. British bomber strength received a badly-needed shot in the arm with the flight of the new "medium-heavy", the Avro Manchester, in July 1939, but this very first flight showed trouble with the engines and the need for a major wing re-design.

As war broke out in September, the French increased their orders for



LB.30B No. AM917 in June 1941 at Prestwick, having been delivered there the preceding month. This aircraft was later modified by Scottish Aviation and, equipped with ASV radar and four 20mm cannon, was delivered to No. 120 Squadron in December 1941. It flew on operations until 1944 and was then flown to No 51 MU at Lichfield, where it was eventually sold for scrap value in March 1947.

The situation for Great Britain was indeed grave, and while Fighter Command and the defensive radar networks were well-equipped and ready, retaliatory forces were lean. The Stirling—already suspect—went into initial squadron service in August 1940 and the limping Manchester had still not received Service clearance; Halifaxes would not join Bomber Command until the end of the year.

On August 8, only a month after the Air Ministry had described the B-24 as “inferior” to the Stirling, the British Ambassador in Washington passed a list to the US authorities showing items regarded as the UK’s most immediate and important requirements—in this short list the second item was “. . . 50 Consolidated bombers . . .”. This followed Winston Churchill’s first message as Prime Minister to President

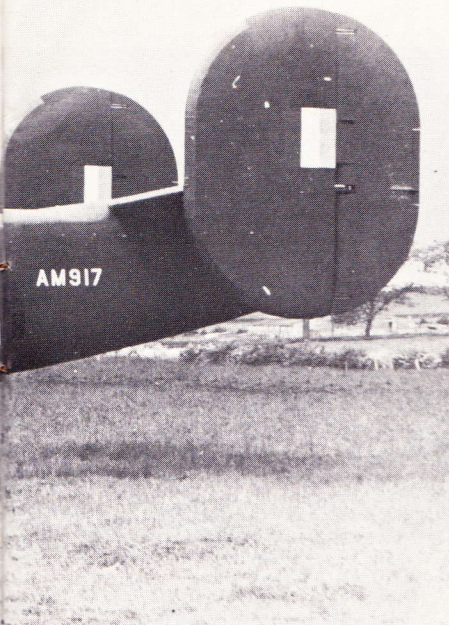
Roosevelt in which he stated that the British needed the latest types of aircraft of which the American services were then taking delivery—he went on “. . . these can be repaid by those now being constructed in the USA for us.” Prophetic words, which were gladly taken literally by the Americans after the Japanese attack on Pearl Harbour, resulting in the retention of many of the original LB.30 aircraft.

But Roosevelt, who believed that the Munich Agreement had been forced upon the Allies because of their inferiority in the air, received the British requests with sympathy and in October 1940 ratified an agreement to release twenty B-17s and thirty-five B-24s to the British off direct Air Corps contracts.

The B-17s were production models, but the B-24s comprised almost all the original order for USAAC service test aircraft (YB-24) and most of the first production batch (B-24A). It was accepted by C. R. (later Sir Richard) Fairey, of the British Purchasing Commission, that the American bombers would be accepted by the British as originally ordered for the USAAC, ie without British equipment as had by now been specified for the direct-purchase LB.30s.

The first six aircraft off the line at Lindbergh Field, San Diego, had been ordered as YB-24s, this designation being applied to “service test” aircraft—but they were in fact passed over to the British as B-24s, the seventh aircraft retaining its YB-24 nomenclature and going to the US Army Air Corps. This initial batch was taken off USAAC Contract No A-5068 and paid for in cash; the next batch of 20 aircraft were the first off the line of B-24As, and this contract—again paid for in cash—was carried on Contract F-677, the original French order for LB.30s. The final batch of nine aircraft making up the promised total of thirty-five (under US Requisition No 65) was in fact never passed on, the aircraft concerned going to the USAAC as its first delivery of B-24As. The British Ministry of Aircraft Production now allocated serial numbers and at first it was intended that they should follow those allocated for the LB.30 contract (139 aircraft, serial numbers AL503-641) bringing the serial batch up to and including AL667. But the marked difference in the two basic types—LB.30 and B-24/B-24A—led to a change in official policy and the ex-USAAC aircraft were allocated new and separate serial blocks. This is perhaps

<i>Contract No</i>	<i>USAAC Model</i>	<i>USAAC Serials</i>	<i>British Model</i>	<i>British Serials</i>	<i>Notes</i>
A-5068	B-24	40-696/40-701	LB.30A	AM258/AM263	6 aircraft. USAAC serials re-allocated to B-24Ds.
F-677	B-24A	40-2349/40-2368	LB 30B	AM910/AM929	20 aircraft. USAAC serials re-allocated to B-24Ds.
Req 65	B-24A	40-2369/40-2377	LB 30B	—	9 aircraft. Not released. Delivered to USAAC.



better explained in the table.

As will be seen, the decision had also been taken on nomenclature—the first batch of six aircraft were designated LB.30A (logically, in a sense, following the first contract which called up the LB.30) and subsequent aircraft of a different pattern again were designated LB.30B. The situation became a little more confusing when the LB.30s entered service and were designated “Liberator Mk II”—the apparently later designation LB.30B then had become the “Liberator Mk I”. The generic name, “Liberator”, had been formally adopted by the British in November 1941 and was later used by the United States’ and other forces. To clear up the overall picture of early deliveries, it should be noted that the US Army Air Corps only received one YB-24, serial No 40-702. Constructor’s numbers for AM258-263 ran from 1 to 6, and for AM910-929 began a new series from 1 to 20.

Arrangements were now set in train to effect delivery of the American bombers by air to the UK; at this point the story must concentrate on the Liberator picture, for the Boeing B-17s released by the USAAC were simply delivered—the Liberator, with its high capacity fuselage and longer range, assumed a much greater significance from the outset. For the record, the first B-17C—RAF name Fortress Mk I—flew to the UK from Gander on April 14, 1941.

On the first day of August 1940, Captain A. S. Wilcockson (who had captained the flying boat *Caledonia* on the first transatlantic survey flights

in 1937) and Lt Colonel H. Burchall (a senior official in BOAC), arrived in Canada to arrange flight delivery of all the American aircraft capable of flying the North Atlantic, the work to be carried out under the auspices of the Ministry of Aircraft Production in collaboration with Canadian Pacific Railways. An Air Service Department was set up within CPR and Col Burchall became general manager with Captain Wilcockson in charge of operations. Shortly afterwards some of the star BOAC captains arrived in Montreal—among them Captains R. H. Page, I. C. Ross, and the incomparable D. C. T. Bennett, who became Flight Superintendent in charge of flying and training. An extremely valuable addition to the team was Captain G. J. Powell who was, as Bennett later put it, found teaching navigation as a squadron leader in the RCAF; Captain Powell was of course, a highly experienced ex Imperial Airways captain. The base of operations was to be the Montreal airfield at St Hubert, used until the newer and much larger airfield at Dorval was completed.

Captains Bennett and Page were first given the task of ferrying arrangements for the pre-war contract Lockheed Hudsons, and they brought back to Montreal the first two of these aircraft for training; among the many other problems was the organisation of ground support services both at Montreal and at Gander (previously “Hattie’s Camp”). But Bennett worked hard and well, and in November 1940 led the first delivery flight of seven Hudsons across the Atlantic from Montreal, via Gander, to Aldergrove in Northern Ireland.

As the CPR Air Service Department got under way, it was suggested—in September 1940—that BOAC should take the first batch of Liberators (LB.30As) to start a transatlantic service in view of the excellent range characteristics demonstrated by the prototype XB-24—this was eventually agreed in basic principles and by November 25, 1940, the British Air Commission was signalling the MAP that the first LB.30A was being prepared for flight delivery to the UK, and that the next five aircraft would be “stripped for transatlantic work” for delivery by the end of the year—Consolidated had forecast the first delivery date as December 5, 1940.

This first LB.30A was then destined for “turret work” in the UK, but some delays were encountered when the US authorities refused to release the then highly-secret Norden bomb-sight, and

the British Liberators were held until the situation was eventually resolved with the release of the Sperry O-1 bombsight and also the decision of the MAP to accept the LB.30As in the stripped condition referred to previously.

In January 1941 the organisation at Montreal was changed—Mr C. H. Dickens of Canadian Airways was put in charge of the CPR Air Service Department and Col Burchall went to the British Air Commission in Washington; Captain Wilcockson became Training Superintendent and Captain Bennett remained Flight Superintendent. The scene was now set for the delivery of the Liberators.

But staff complications made themselves apparent at this juncture, for Squadron Leader David Waghorn and Flight Lieutenant Maurice Summers arrived, charged with the task of test-flying the first LB.30A and delivering it to the UK, only to find that Colonel Burchall had placed the same task on Captain S. T. B. Cripps of BOAC; Summers and Waghorn arrived at San Diego on January 15, 1941, and the first LB.30A (AM258) was rolled out two days later. An arrangement was then reached between Summers, Waghorn and Cripps, whereby the latter took over this aircraft after an initial flight had been made by Consolidated’s test pilot. Captain Cripps—one of BOAC’s most experienced pilots—carried out fuel consumption and cold weather performance trials on AM258, and then Summers and Waghorn took over the second aircraft (AM259) and evaluated handling characteristics and general performance parameters.

By the end of February 1941 AM259 was at Montreal/St Hubert, where it had been delivered on February 23, AM258 remaining on test at San Diego. The third to sixth aircraft were expected to be delivered at the rate of one per week from mid-March 1941 onward although the feeling at Montreal was that Consolidated was being “Very off-hand and . . . refused to do anything but push the first six out of the hangar . . .” Summers and Waghorn had experienced something of this attitude, for the company had taken a strong line about the initial delivery flight to Canada from the West Coast and insisted that its own pilots flew AM259 to Montreal. Although there was some truth in the situation as described at San Diego at this time, the pressures on the company were severe and certainly there were few causes for complaint in later dealings.

To be continued

The Versatile Skyhawk



THE versatile Skyhawk military aircraft is in production at the Douglas Aircraft Company division of the McDonnell Douglas Corporation for use as an attack bomber, strike fighter or advanced jet trainer. Seven different versions of the small but powerful A-4, effective either as a bomber or quick-response strike fighter, and the TA-4, a two-seat trainer, have been delivered to the United States Navy for carrier operations and operational training and for Marine Corps use as a tactical aircraft. In addition, with the authorization of the US Government, Skyhawks in several versions have been exported overseas for operation by the Israeli Air Force, Royal Australian Navy, Royal New Zealand Air Force and the Argentina Navy and Air Force.

More than 2 700 Skyhawks have been built. One of only a handful of US military aircraft to reach that level of production since World War II, the Skyhawk is manufactured at the Douglas Aircraft Company division of McDonnell Douglas in Long Beach, Torrance and Palmdale, California.

One of the latest of the tactical Skyhawks in US military service is the A-4M Skyhawk II, the most powerful of the family of rugged, bantamweight aircraft. Built for operation by the Marine Corps, the A-4M is produced under contract to the Naval Air Systems Command.

The multi-mission armament of the A-4M includes air-to-air missiles and guns for fighter assignments or bombs and guns for close air support of ground forces from forward airfields or from carriers. Incorporated in the A-4M are a number of improvements over its predecessor Skyhawks. Chief among the advances is a new and more powerful Pratt & Whitney engine—

the J52-P-408A, generating 11 200lb of thrust for take-off. The additional power increases the Skyhawk's manoeuvrability, rate of climb and acceleration, enhancing its already impressive record of combat survivability. Speed of the A-4M is in the high subsonic range—about 700mph. Another A-4M feature, a ribbon-type drag chute, combines with wing-lift spoilers and the more powerful engine to improve the Skyhawk short-field landing performance, making it the first of the series with combat operational capability from 4 000-foot landing fields.

Other A-4M changes include a greater ammunition capacity for the two internally mounted 20mm or 30mm guns, a more powerful generator, a self-contained engine starter and a larger windscreen and pilot canopy, providing greater head room and visibility. Also incorporated in the A-4M are basic Skyhawk design features of earlier models, such as nose-wheel steering, in-flight refueling capability and the McDonnell Douglas ESCAPAC 1-C-3 zero-altitude, zero-speed emergency ejection system.

Weighing only 10 600lb empty, the A-4M can take off fully loaded at a gross weight of 24 500lb, including 8 200lb of all types of modern tactical armament. It is 40.3 feet long, 15 feet high and has a wing span of only 27.5 feet. As with other Skyhawks, this small wing span permits it to be housed comfortably in carriers without folding the wings.

Flight characteristics of the A-4M, particularly its high-speed stability and its excellent controllability, make it an effective platform for the sophisticated weapons delivery system it carries. The A-4M made its maiden flight on April 10, 1970, and was first delivered

Above: The A-4C, first flown on August 21, 1958.

Right: An A-4C leaves the flight deck of USS *Enterprise*, world's first nuclear-powered attack carrier, during US Sixth Fleet exercises in the Aegean in 1964.

Bottom left: Striking head-on study of an A-4K as supplied to the RNZAF.

Bottom right: Two-seat TA-4F Skyhawk, first of which began to reach the US Navy in May 1966.

to the US Navy on November 3, 1970.

Newest and most sophisticated international version of the Skyhawk is the A-4N Skyhawk II, which contains several advances over its predecessors. These improvements include a navigation and weapons delivery system described as equal to or better than any operational system today, two 30-millimeter cannon, a redesigned and simplified cockpit layout and a new Sundstrand constant speed drive. Major elements of the navigation-weapons system are a Lear-Siegler digital computer, Kearfott inertial platform and an Elliott head-up display.

A-4M features incorporated into the A-4N include the Pratt & Whitney J52-P-408A engine, as well as the self-starter, landing drag chute, wing-lift spoilers and larger windscreen and pilot canopy. Maiden flight of the A-4N took place on June 12, 1972, and this model is in production for the US Navy and the Israeli Air Force.

Another version of the Skyhawk in production at Douglas is the TA-4J jet trainer. It is built without combat equipment, resulting in a lighter aircraft and simplifying maintenance requirements. Flown by Navy operational training squadrons, the TA-4J has a maximum range of about 2 000 miles when equipped with external fuel



tanks and an endurance of more than four hours, nearly double the flight training time of earlier jet trainers.

Other TA-4 versions of the Skyhawk possess the performance and armament capabilities of the tactical Skyhawk, in addition to their training function. Designed to operate from carriers or from forward landing strips these two-place models can carry bombs, rockets, missiles and guns.

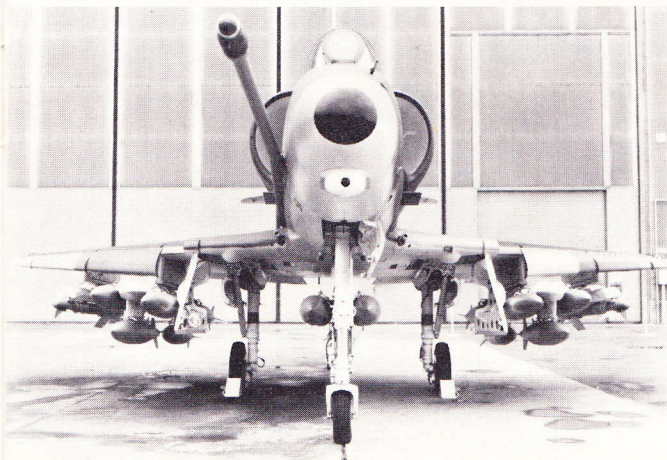
Design of the Skyhawk trainer is essentially the same as that of the basic Skyhawk, with the exception of a 28-inch extension of the fuselage to accommodate the second seat and a dual set of controls.

Left: Maiden flight of the A-4M Skyhawk II was made from Palmdale (California) Airport on April 10, 1970.

Since the initial delivery of the first Skyhawk in 1956, the durable jet aircraft has logged more than 3½ million flight hours in all versions. In the Vietnam conflict it was used by the US Navy and Marine Corps on more combat missions than any other operational aircraft. This high utilisation stems from its flying simplicity, its low maintenance requirements, its multi-mission capability and the agility, small size and ruggedness which produce its superior survivability record.

Basic Skyhawk versions and the year each became operational:

A-4A in 1956, A-4B in 1957, A-4C in 1959, A-4E in 1962, TA-4F in 1966, A-4F in 1967, TA-4J in 1969, A-4M Skyhawk II in 1970 and A-4N Skyhawk II in 1972.



NEW Zealand agricultural products are well known for their quality, but to achieve this standard, large tonnages of trace elements, ie superphosphate, must be added to the soil. As much of the country is hilly and mountainous, there are only two methods of application of the superphosphate—by hand and from the air.

During 1949, commercial operators began top-dressing with aircraft, following a short period of trials by government agencies. The only aircraft available in numbers was the de Havilland 82A Tiger Moth. This was not an entirely suitable choice but, with a unique breed of pilots, later to be referred to as the “supermen”, the industry soon became established as an integral part of the farming scene.

Five operators began trials early in 1949: Airwork (NZ) Ltd, Aircraft Service (NZ) Ltd, James Aviation Ltd, Rural Aviation Ltd, and Gisborne Aerial Topdressing Co Ltd. They were quickly followed by others until, by the peak period in 1957, there were more than 60 operators.

The Tiger Moth was the most prolific NZ-registered aircraft and top-dressing operators obtained their equipment from a number of sources. A small number of Tiger Moths were delivered to aero clubs pre-war and the survivors were impressed into the RNZAF when hostilities began. Three hundred and thirty five aircraft were delivered during the war, some new from RAF orders, the London Aeroplane Club's fleet, some built at Hatfield to RNZAF orders, some Hatfield-built but New Zealand-assembled, and some built by DH New Zealand and DH Australia. After the war a large number of Tiger Moths were overhauled and released to aero clubs and private owners. Although the RNZAF continued to retire the trainers, the mounting top-dressing boom with its high attrition rate made it obvious that other sources would need to be found.

In 1950 the British and Australian imports began to arrive. However with the appearance of more modern agricultural aircraft such as the Super Cub, Cessna 180, Fletcher FU-24, and Pawnees, the Moth quickly faded from the farming scene. A small number were retained for spraying operations, at least two still being used for this work during 1970. As well as top-dressing and spraying, Tigers were used for dropping poisoned rabbit bait and for seed sowing.

I was an engineer with Aircraft Service from the time it commenced ag work until the introduction of the FU-24, and the history of this operator is typical of this period. It was obvious from the start that the Tiger was far from ideal, its availability being its main attraction. Superphosphate is an extremely fine powder and it entered any openings in the aircraft structure. Corrosion of the metal, rotting of the fabric and deterioration of the glued joints resulted, and it was a constant battle to keep the ingress of dust to a minimum.

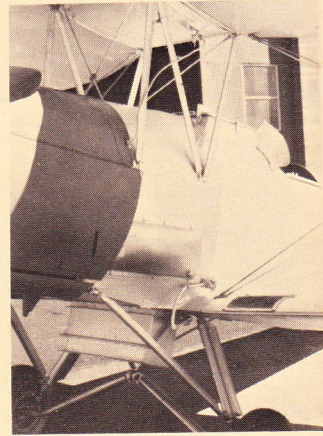
With the problems of the hopper installation overcome, further modifications then followed. A fabric fillet was fitted to the lower wing, a metal cover fitted over the rudder bars, a chamois leather bag sealed the bottom of the control column, where it came through the floor, and the lacing under the rear fuselage was taped over. The bottom wings still had to be opened up regularly however, and one operator fitted a plywood panel between the bottom wings.

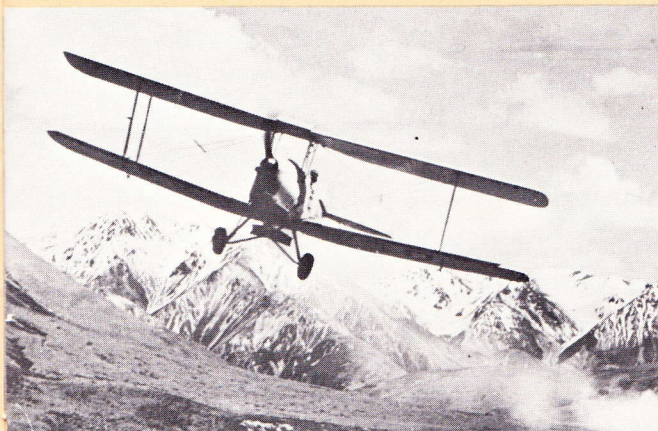
Loading the aircraft was accomplished by the loader jumping on the wing walk, undoing the hopper lid, guiding the loading hopper, pulling a handle to release the dust, securing the lid, and jumping off the wing as the Tiger moved away, in about the time it takes to tell. The wing structure under the walkway quickly deteriorated but a heavy plywood panel covering the platform ribs proved a satisfactory remedy.

Many landing strips were on the side of a hill, landings

New Zealand Agricultural Tiger Moths

Kenneth Meehan





being made upwards, take-offs downwards. The undercarriage took a pounding it was never designed for and broken springs and bent bolts were a constant worry. The aluminium fork ends were replaced by steel ones, the compression leg fairings were removed and a safety chain was fitted between the leg and the axle.

The tailskid had an old file blade welded vertically to it to give better steering, but then the lower rudder ribs and fin post had to be strengthened. The top wing trailing edge was cut back at the root to give more clearance to the loading hopper. All flying wires were encased in plastic.

The main modification, of course, was the fitting of the hopper. The front seat and control box was removed, and the decking from the rear centre section struts back to the rear cockpit was replaced with an aluminium one fitted as part of the hopper. Various outlets were tried, a shallow full width one being most widely used. Enlarged windshields of various shapes were fitted and, later, headrests too.

Manager of Aircraft Service was D. A. Grieg, a wartime fighter pilot and a brilliant flier with exceptional engineering ability. Some of his ideas included in the Tiger Moth experimental modifications were: Corsair tail wheel oleos for main undercarriage legs, Corsair rudder pedals, adjustable seat, torch battery-operated stall warning device and wind-driven agitator. The fitting of brakes was also considered but was considered too expensive. The standard exhaust manifold gave a lot of trouble and individual stacks were fitted. Fairey-Reed metal propellers were used on a few aircraft, although care was needed to prevent overspeeding.

Owing to the rugged nature of the landing strips and numerous accidents a large number of spare components were held in stock. Even though I worked there I soon lost track of the true identity of some of the 13 Tigers we had. These aircraft came from aero clubs and private owners, spare components being obtained in England and Australia. Twelve sets of parts were obtained from Sydney, most still in RAAF colours, with one that had been used as an ambulance by the RAN.

The configuration of the Tiger did not change greatly, although McGregor Aviation planned a project that featured the fitting of a Auster wing in parasol position.

The ag Tiger's hopper carried between 500 and 600lb of material. Loading, which was initially by hand, quickly progressed from Heath Robinson-like structures fitted to a variety of trucks and tractors, to sophisticated, self-contained units. Pilots and drivers lived in caravans and the loading trucks also carried a refuelling unit, with tools and spares.

Agricultural Tiger Moths continue to survive; the Museum of Transport and Technology has several awaiting restoration for static display and James Aviation kept its first aircraft, ZK-AJO, which flew 6 914 hours between 1949 and 1959.

Facing page, top left, centre left and top right: Variations in hopper styles. James Aviation (ZK-ARB), McGregor, Aircraft Services (NZ) Ltd (ZK-BDG).

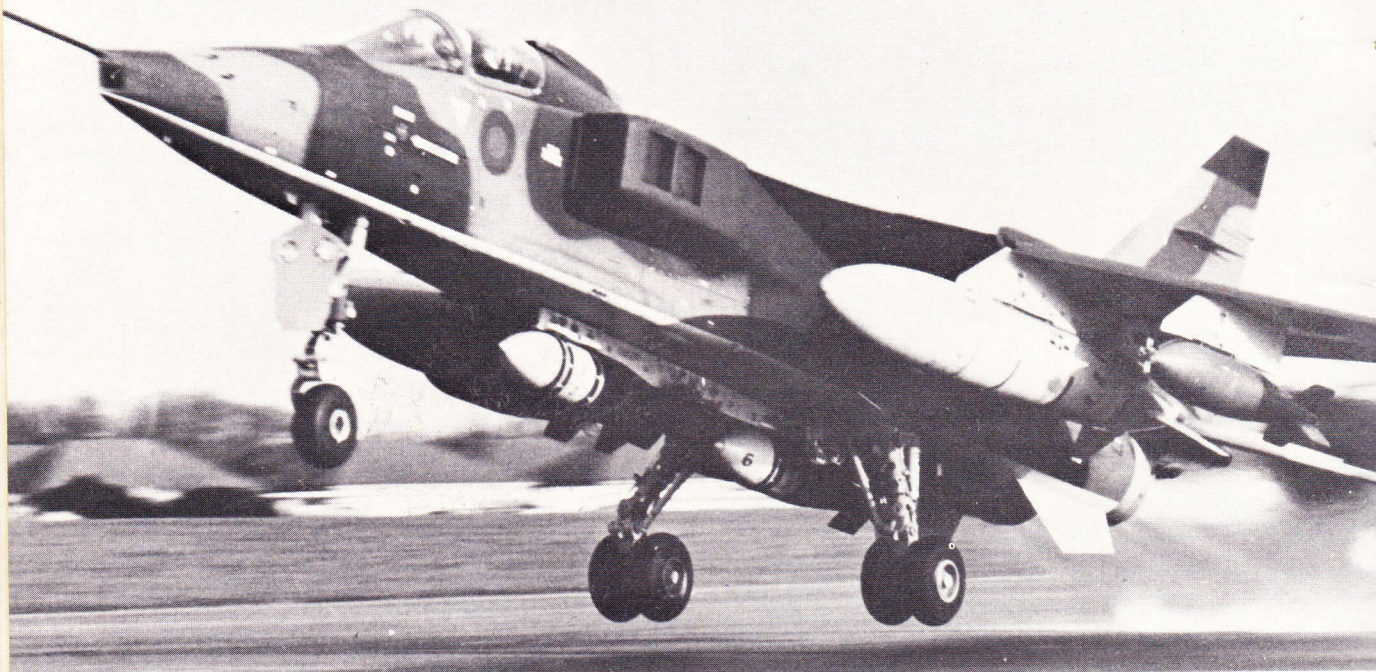
Facing page, bottom: Another of James Aviation's Tigers, ZK-AKO ex NZ1419, with seed outlets fitted to the hopper.

This page top to bottom: ZK-BDG ex A17-105 used by Aircraft Service (NZ) Ltd 1953-1961. Colour scheme was silver and red.

ZK-ALP ex NZ654 of Aerial Farming (NZ) Ltd, 1950-1959. Hills in background are typical of the country top-dressed.

First topdressing trials in South Island were made by ZK-ASO ex NZ688 in 1949.

This silver and green, spray-equipped Tiger, ZK-AUT ex VH-BEQ, was used by Weedair Ltd between 1956 and 1960 and incorporated parts from the fuselages of three other Tigers.



The Hardware Revolution

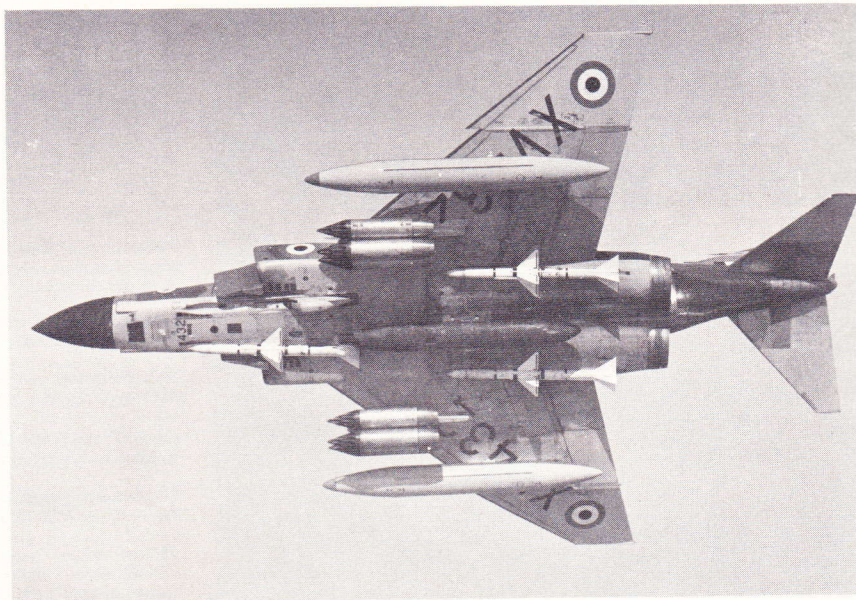
Right: A Jaguar releases a 1 000lb retarded bomb during weapon delivery trials made from West Freugh, Scotland.

Below: Phantom FGR2 of 6 Squadron carrying two groups of SNEB rocket pods, three Sparrow air-to-air missiles, a strike camera in one of the forward missile bays, auxiliary fuel tanks and a centre-line cannon pod.

AT the outbreak of the 1914/18 War the flimsy military aeroplanes of the Royal Flying Corps and Royal Naval Air Service, predecessors of the Royal Air Force, were experimenting with new aerial mines and grenades to use against enemy airships and ground forces. It was thought that up to 40lb of explosives could be dropped from a height of 350ft without damage to the carrier aircraft. To launch smaller weapons the pilot or observer leaned over the side of the cockpit and dropped the lethal devices from his grasp!

Today, less than sixty years later, one RAF strike fighter can deposit a bomb load of 16 000lb on to a moving target with pin-point accuracy. Such is the "hardware revolution" that has changed the tactics of warfare way beyond the dreams of yesteryear's science fiction writers.

When the Buccaneer low level strike aircraft first entered service in the early sixties it could carry a maximum weap-





ons load of 8 000lb. With progressive development and the adoption of new weapons pylons, the latest versions of the Buccaneer can now lift double this load. Similarly the Phantoms, Harriers and Jaguars that have succeeded the Hunter and Canberra in front line service, or are about to enter service, can carry weapons loads many times greater than the older machines.

With the cost of new aircraft increasing in direct proportion to the increase in sophistication demanded, it is obvious that each replacement machine must be very cost effective and able to "carry the mostest". A good example of this is the Harrier. Despite its diminutive size it carries a very good weapons delivery system and can carry 5 000lb of ordnance. This is about double the load of the Hunter which it replaced in service, and is likely to be improved upon as uprated Harriers enter service. Although numbers of new aircraft en-

tering service do not numerically replace the types being retired, they more than make up for this by their extra hard hitting capabilities. One squadron of Buccaneers can carry twice as much weaponry as a Canberra squadron. A Phantom squadron has a greater punch than five Hunter squadrons!

This more recent weapons revolution has come about largely as a result of two developments. The first is the extra thrust to weight ratios now available from modern, efficient jet engines.

The Harrier's Pegasus turbofan produces enough power to vertically lift its own weight plus that of the aircraft, plus a heavy war load. A few years ago such a feat was technically impractical for an operational machine.

The second development is the evolution of multiple carriage weapons pylons. The practice of containing offensive stores within an integral bomb bay has gone out of fashion

largely for weight reasons. It used to be unthinkable to consider any bomber lacking a bomb bay, but the shape of the bay was very restricting on the type of ordnance carried, even though internal carriage does cut down on drag and marginally increase speed. The added complication and weight of an internal bomb bay is not justifiable on a small attack aircraft though it becomes more viable on larger bombers such as the Buccaneer, Vulcan, and Victor.

Multiple weapons carriage was an obvious development as soon as increased power gave greater load carrying capability. Instead of carrying only single bombs or weapon pods on each of the aircraft pylons, the latter are now fitted with multiple carriers, which permit the loading of more than one weapon on each pylon. The three types of carrier now in RAF use can carry two weapons in tandem, two side-by-side or three in a clover leaf group, depending on their design and the

aircraft to which they are fitted. The weapon release units are of the standard NATO pattern and so virtually any type of weapon can be carried. All of our front line ground attack aircraft, the Harrier, Phantom and Buccaneer, are equipped with multiple weapons carriers and so will be the Jaguar and MRCA.

It is not just the ordnance lift capability of modern RAF aircraft that has improved. The firepower itself has been developed dramatically over the last decade. Heavy, but inaccurate, ground-attack rockets, dating back to World War II, continued in use until comparatively recently but have now been totally replaced by podded rockets of very compact external dimensions. These armour piercing rockets are of the high velocity type and are fitted with hollow charge warheads which will penetrate with ease the armour of any modern tank or warship. Over 200 such rockets can be carried by one aircraft and they can be fired either in a battleship-like salvo, or rippled off a pod at a time, depending on the type of target being attacked.

New bombing techniques have resulted from the introduction of retarded bombs. These weapons are slowed down in flight by small parachutes which deploy immediately after release. They can be dropped safely from very low altitudes and this minimises the aircraft's vulnerability to enemy defences and still ensures accurate delivery.

Another new weapon particularly effective against enemy armour is the Cluster bomb. This is similar in size and shape to the standard 1 000lb bomb but shortly after release its casing peels away, releasing a large number of armour piercing bomblets which fall in a high density cloud, saturating the target area. Dropped in sticks along an advancing column of enemy armour these cluster weapons would create havoc. Although designed primarily as anti-armour weapons, the bomblets are also exceptionally effective against personnel.

The Hawker Siddeley Martel air to ground missile will shortly become a highly effective addition to the RAF's armoury. The missile will serve in the TV guided version as a stand off weapon against land or ship targets and in the automatically homing versions as an anti-radar weapon blinding enemy control stations and making life easier for other attacking aircraft.

The RAF's ability to navigate accurately to its targets and release its weapons with precision has been improved in step with the weapons them-

selves. The new attack systems are based on inertial navigation principles using space gyros; they are independent of ground stations and are therefore secure and can be used worldwide. Using built-in computers they provide very accurate navigation information, which eases the task of finding the target and thus permitting the crew to concentrate on tactics. Once the target is located, the INAS gives precise weapon aiming information making all the necessary calculations such as aircraft speed, firing range and surface wind, which previously had to be assessed and allowed for by the pilot. So sophisticated is this equipment that it can even release weapons automatically. The Harrier and Phantom are fitted with a first generation INAS which is an analogue system; the Jaguar and MRCA are being equipped with second generation digital systems, which will have even greater capability.

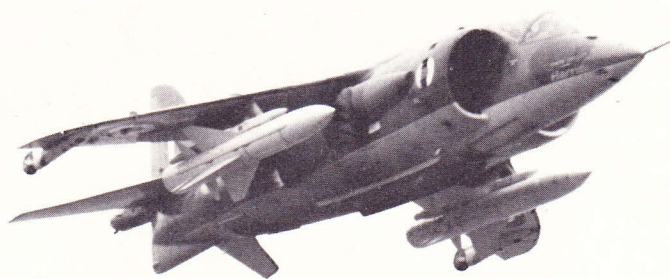
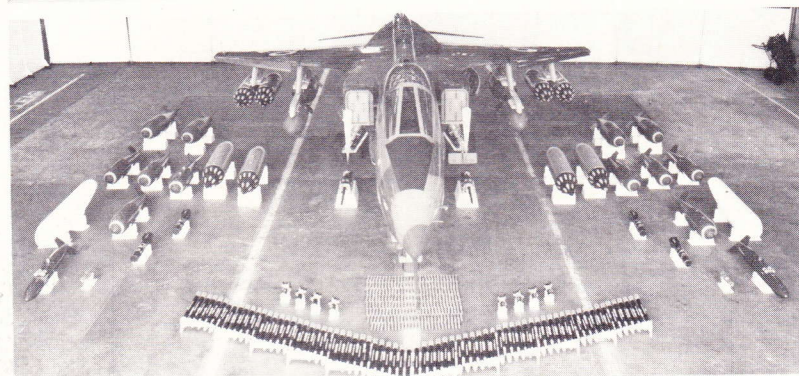
The Harrier and Jaguar will soon be fitted with the Ferranti Laser Range

Above: Some of the modern ordnance which can be carried by a Phantom (top) and Jaguar.

Below: Harrier armed with two radar-homing versions of the Anglo-French Martel air-to-surface missile.

Finder and Marked Target Receiver (LRMTR) which performs two functions. First it provides the pilot with extremely accurate range finding which has previously been the one thing the ground attack pilot has lacked; this innovation will therefore greatly increase weapon delivery accuracy. Its second function is to enable targets which are designated on the ground by a Forward Air Controller to be located and identified by the pilot; this will greatly enhance the speed and efficiency of close air support operations.

With all these new weapons and the increase in lifting capabilities of the latest combat aircraft it can be seen that the RAF's conventional teeth are sharper than ever!



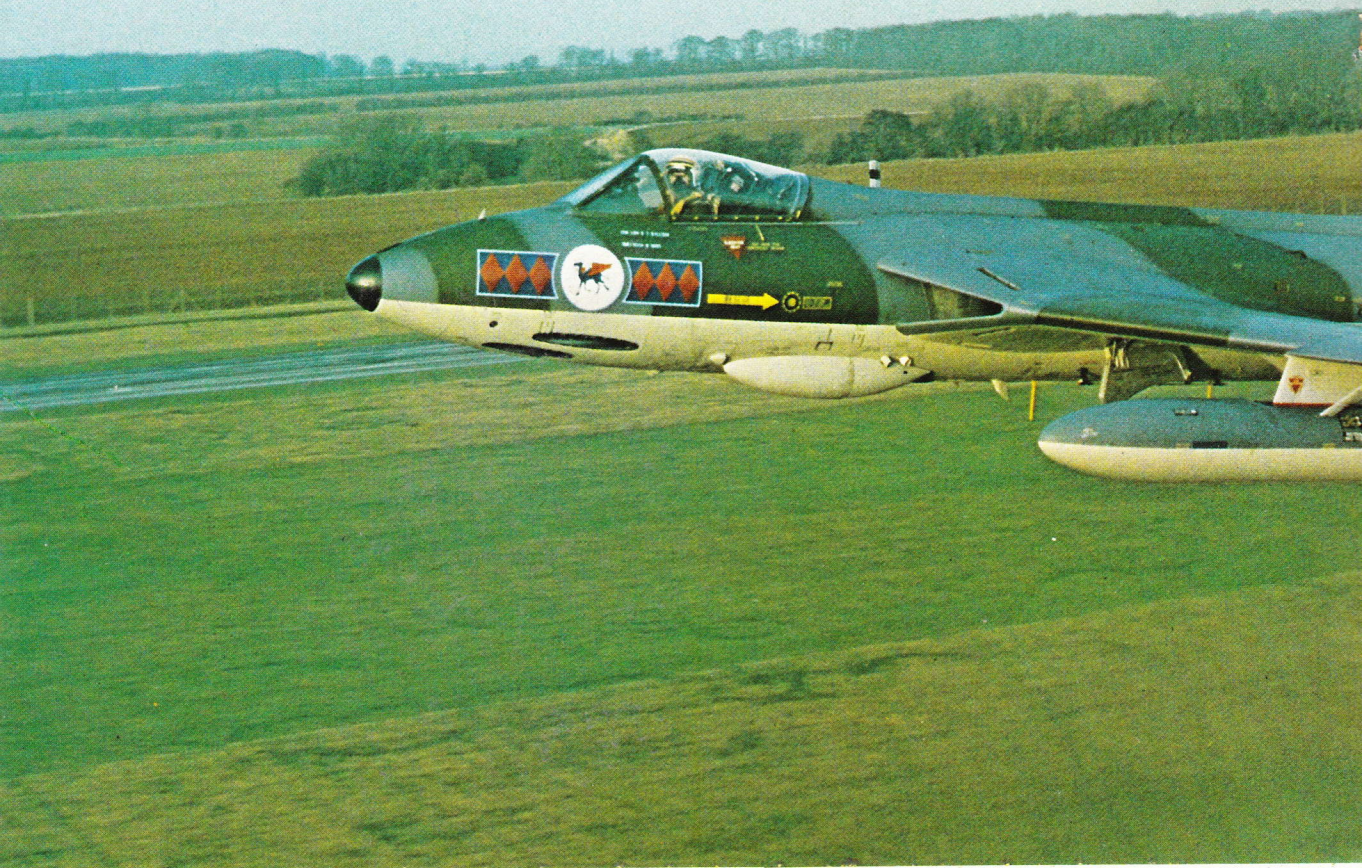
BRITISH CIVIL AIRCRAFT REGISTER

Compiled by A. J. Wright

A SUPERSONIC Concorde, a couple of subsonic Luton Minors and in between mainly Pipers, Cessnas and Islanders comprise the allocations this month. The c/n of G-BBCY looks highly suspect and no doubt in the passage of time will be amended. The Viscount 808 was delivered new to Aer Lingus in 1958 and was later converted to a freighter by Scottish Aviation. The Swiss airline SATA acquired it in 1969 and later was expected to join the now defunct British company Air International. Arising from the ashes, Nor-Air, a new airline at Southend, is now believed to be the future operator of G-BBDK. Finally it is to be hoped that the Fan Jet Falcon stays a little longer than the first one, F-BAOA.

Registration	Type	C/n	Owner or Operator
G-BBCV G-BBCW	Cessna A.188B PA-E23 Aztec 250	01085T 27-4806	Mindacre Ltd (N21865) Scotcourt Executive Air Ltd (N14251)
G-BBCX	Airship (Hot Air) Radio-Controlled	EW.1	E. A. Wills & G. W. Moger
G-BBCY	Luton LA-4A Minor	LA-4A	C. H. Difford
G-BBCZ	AA-5 Traveler	0382	General Aviation Sales Ltd
G-BBDA	AA-5 Traveler	0383	General Aviation Sales Ltd
G-BBDB	PA-28 Cherokee 180	7305361	Spooner Aviation Ltd
G-BBDC	PA-28 Cherokee 140	7325437	Spooner Aviation Ltd
G-BBDD	PA-28 Cherokee 140	7325444	Spooner Aviation Ltd
G-BBDE	PA-28R Cherokee Arrow 200-2	7335250	Spooner Aviation Ltd
G-BBDF	PA-28R Cherokee Arrow 200-2	7335255	Spooner Aviation Ltd
G-BBDG	Concorde	100-002	BAC Ltd Commercial Aircraft Division
G-BBDH	Cessna F.172M	0990	Leicestershire Aero Club Ltd
G-BBDI	PA-18 Super Cub 150	18-5336	J. E. Homewood
G-BBDJ	Thunder balloon AX6-56	006	S. W. D. Ashby & H. B. Ashby
G-BBDK	Viscount 808C	291	I. McClelland & Partners Ltd (HB-ILR/EI-AJK)
G-BBDL	AA-5 Traveler	0406	General Aviation Sales Ltd
G-BBDM	AA-5 Traveler	0407	General Aviation Sales Ltd
G-BBDN	Taylor Monoplane	PFA.1437	D. A. Nice
G-BBDO	PA-E23 Aztec 250	7305120	Sealed Motor Construction Co Ltd (N40361)
G-BBDP	Robin DR.400/160	853	Avions Robin (UK) Ltd
G-BBDR	PA-31 Navajo	31-0056	Mann Aviation Ltd (LN-NPG)
G-BBDS	PA-31 Navajo	7300956	Bejam Bulk Buying Ltd (N7565L)
G-BBDT	Cessna 150H	68839	Eastern Aviation Ltd (N23272)
G-BBDU	PA-31 Navajo	31-537	Erie Electronics Ltd (N6796L)
G-BBDV	SIPA S.903	7	B. Price (F-BEYJ)
G-BBDW	BN-2A-9 Islander	342	Britten-Norman (Bembridge) Ltd
G-BBDX	BN-2A-9 Islander	343	Britten-Norman (Bembridge) Ltd
G-BBDY	BN-2A-2 Islander	344	Britten-Norman (Bembridge) Ltd
G-BBDZ	BN-2A-9 Islander	345	Britten-Norman (Bembridge) Ltd
G-BBEA	Luton LA-4A Minor	SAK.1	S. A. Knight
G-BBEB	PA-28R Cherokee Arrow 200-2	7335292	Northern Executive Aviation Ltd
G-BBEC	PA-28 Cherokee 180	7305478	Spooner Aviation Ltd
G-BBED	MS.894B Rallye Minerva	12.097	Air Touring Services Ltd
G-BBEE	Learjet 25B	25-135	CSE Aviation Ltd
G-BBEF	PA-28 Cherokee 140	7325527	CSE Aviation Ltd
G-BBEG	Bell 206A Jet Ranger	442	Alan Mann Helicopters Ltd
G-BBEH	PA-28R Cherokee Arrow 200-2	7335297	Spooner Aviation Ltd

Registration	Type	C/n	Owner or Operator
G-BBEI	PA-31 Navajo	31-126	Cannon Electronics & Automation Ltd
G-BBEJ	PA-31 Navajo 350	7305058	Webster Aviation Ltd
G-BBEK	Fan Jet Falcon	86	Trader Airways Ltd
G-BBEL	PA-28R Cherokee Arrow 180	30877	Mann Aviation Ltd
G-BBEM	Beechcraft B.55	TC.1616	Eagle Aircraft Services Ltd
G-BBEN	Bellanca 7GC BC	496-73	Airways Aero Association Ltd
G-BBEO	Cessna FRA.150L	0205	Lonmet (Aviation) Ltd
G-BBEP	Not yet allocated		
G-BBER	Bell 47G-5A	25131	CSE Aviation Ltd
G-BBES	Bell 206B Jet Ranger	1104	CSE Aviation Ltd
G-BBET	Bell 206B Jet Ranger	1102	Ben Turner & Son (Helicopters) Ltd
G-BBEU	Bell 206B Jet Ranger	1121	Ben Turner & Son (Helicopters) Ltd
G-BBEV	PA-28 Cherokee 140	7125340	J. E. Fricker (LN-MTM)
G-BBEW	PA-23 Aztec 250	7305075	Ellerman Lines Ltd
G-BBEX	Cessna 185A	0491	Shackleton Aviation Ltd
G-BBEY	PA-E23 Aztec 250	7305160	CSE Aviation Ltd
G-BBEZ	Skyvan srs 3 variant 200	SH.1918	Short Bros & Harland Ltd
G-BBFA	Skyvan srs 3 variant 400	SH.1919	Short Bros & Harland Ltd
G-BBFB	Bell 206B Jet Ranger	1129	CSE Aviation Ltd
G-BBFC	AA-1B Trainer	0245	General Aviation Sales Ltd
G-BBFD	PA-28R Cherokee Arrow 200-2	7335342	Truman Aviation Ltd
G-BBFE	Bell 206A Jet Ranger	29	Astra Aircraft Ltd
G-BBFF	PA-34 Seneca 200	7250076	American Airspeed Incorporated Ltd (N1077U)
G-BBFG	BN-2A-6 Islander	701	Britten-Norman (Bembridge) Ltd
G-BBFH	BN-2A-6 Islander	702	Britten-Norman (Bembridge) Ltd
G-BBFI	BN-2A-6 Islander	703	Britten-Norman (Bembridge) Ltd
G-BBFJ	BN-2A-6 Islander	704	Britten-Norman (Bembridge) Ltd
G-BBFK	BN-2A-6 Islander	705	Britten-Norman (Bembridge) Ltd
G-BBFL	Not yet allocated		
G-BBFM	BN-2A-6 Islander	706	Britten-Norman (Bembridge) Ltd
G-BBFN	BN-2A-6 Islander	707	Britten-Norman (Bembridge) Ltd
G-BBFO	BN-2A-6 Islander	708	Britten-Norman (Bembridge) Ltd
G-BBFP	BN-2A-6 Islander	709	Britten-Norman (Bembridge) Ltd
G-BBFR	BN-2A-6 Islander	710	Britten-Norman (Bembridge) Ltd
G-BBFS	Free balloon	75	A. J. F. Smith
G-BBFT	Cessna A.188B	01270T	Lonmet (Aviation) Ltd
G-BBFU	PA-E23 Aztec 250	7305124	Not known (N40364)
G-BBFV	PA-32 Cherokee Six 260	32-778	Spooner Aviation Ltd
G-BBFW	PA-E23 Aztec 250	27-219	Not known (5Y-KRB)
G-BBFX	PA-34 Seneca 200	7250109	Not known (5Y-APJ)



Flying Colours

Above: One of the Hunter FGA9s which No 45 Squadron at RAF Wittering, Hunts, is using for training pilots for the RAF's new Jaguar tactical strike fighter photographed last December. Winged camel badge commemorates the fact that No 45 flew the famous Sopwith Camel fighter in the First World War.

John Tweddell, HSA (Kingston Divn)

Above right: A Harrier of No 1 Squadron from Wittering in temporary "snow camouflage" during Exercise "Sky Mist" which was held in northern Scotland last winter.

John Tweddell, HSA (Kingston Divn)

Right: Fly-by-wire Hunter: the Royal Aircraft Establishment's unique green Hunter T12, seen here during a sortie last April, has now embarked on a test programme in which it makes complete flights using quadruplex electrically-signalled flight-control equipment which is being developed by the RAE.

Peter Hudson, RAE Bedford



MODELLING WORLD

James Goulding

Frog's Hellcat

continued from last month

The whole of the engine cowlings is removable to permit the engine to be viewed, the propeller only being a push-fit on the propeller shaft to make this possible. Separate windscreens are provided for either the F6F-3 or F6F-5 versions.

A ventral drop tank installation adds interest to the model if required, and six underwing rockets are included for the F6F-5 variant. If these latter items are installed, holes in the wings have to be opened up.

The wheels and tyres on this model are fine mouldings and add additional realism to what is a very beautiful model. Comparing this model with Revell's Spitfire, Hurricane and Typhoon, one realises just what a hefty piece of machinery was the Hellcat—but functionally shapely too.

Transfers in the kit permit the selection of one of two alternatives. One is an F6F-3 Hellcat I of 800 Squadron, Fleet Air Arm, in Temperate Sea scheme, based on HMS *Emperor* in 1944. The other is an F6F-5 of 1 Flotille, *Aeronavale*, in French Indo-China during 1945. This was finished in overall gloss Sea Blue. I am delighted these days with Frog's British aircraft markings, which are now extremely accurate in colour. I would respectfully suggest that other manufacturers could well refer to them for colour guidance.

The cost of the Frog/Hasegawa Hellcat kit is £2.50 and the Bf109E is £1.54.

A big Harrier

Being a unique aeroplane in many ways, it was inevitable that the Hawker Harrier GR Mk1 would become a favourite subject for the kit manufacturer. So far we have had 1/72 scale models from Frog and Airfix, with a third from Matchbox to come. We have had a 1/48 scale Harrier from Tamiya. The biggest of all will be Airfix's massive 1/24 scale kit, which is due later this year.

Biggest Harrier to be released at the time of going to press is Revell's 1/32 scale GR1A single-seater. This model makes an interesting comparison with other 1/32 scale models—notably Revell's Hawker Typhoon and Hurricane. It is interesting to note how the proportions of fighter aircraft have changed over the years, especially with the advent of the jet engine and the swept or delta wing. Dimensionally the Harrier is little bigger than the Typhoon, but whereas fighters in earlier years had a wing span considerably greater than their overall length, the modern jet fighter has an overall length greater than its wing span. But it is in the respective fuselage lengths that the greatest contrast exists, and which makes the modern jet fighter

such a massive piece of machinery compared with the typical piston-engined fighter of World War II.

Revell's Harrier kit makes up into a generally good model of impressive size, but it is not without items that require attention to bring it up to the latest standard. The only major item requiring modification is in the appearance of the forward jet outlet fairing, which in the kit is shown in the form used on the pre-production Harriers. This fairing originally appeared as a separate streamlined bulge immediately aft of the engine intakes, but early in the production life of the Harrier it was smoothed into the surrounding fuselage structure and has remained in this form ever since. Modification of the Revell model is easy, using body putty or similar filler to smooth out the bulged fairing into the fuselage.

Unfortunately, Revell has merely engraved the two main nose undercarriage doors instead of supplying them as separate items. This is, I feel, making life difficult for the modeller. On early production Harriers these doors remained closed when the nose undercarriage was either retracted or in the "down" position, only opening during the retraction or extension sequence. Photographs taken in recent years usually show that these doors are left open while the aircraft is standing on the ground. This may be for servicing reasons, but it may also be that the retraction system has been modified. Either way it would have been an advantage to have these doors as separate items in order that the modeller could have the option of fitting the doors in either manner. Personally, I prefer to see them open.

In my opinion the Harrier is one of the most difficult and tedious models to make, in any scale. Because of the side jet exhaust nozzles and excessive wing anhedral, painting after wing assembly is very difficult. It is therefore advisable to complete and paint the fuselage beforehand, leaving wing assembly and the addition of the jet nozzles until later. Because the camouflage of the upper surface extends around the wing leading edge onto the under surface and because the anhedral makes it difficult to paint into the wing roots on the under side, it is advisable to complete the wing before assembly. The underwing serial transfers must also be added before the underwing stores are cemented into position. These stores, which in Revell's kit include rocket pods and drop tanks, must be painted separately before cementing in place because they are so close together on the short-span wing. The tailplane and main undercarriage unit are also better completed and painted before assembly.

The fuselage of Revell's model has a removable engine bay door through which the detailed engine may be viewed. The engine is a good representation of the Pegasus 6, inside of which is a linking mechanism which enables all the jet exhaust nozzles to rotate together. This mechanism is a little weak on initial production Revell kits and I understand that it is being strengthened.

In addition to the underwing stores, this model has the underfuselage gun packs included as optional items.

All panel and skin lines on this model are engraved as raised lines to cut costs, but personally I would have preferred to see at least some of the panels indented rather than raised—although I appreciate that this is more costly. In a model of this size indented panels do add realism.

The transfer sheet provides markings for two versions, a Harrier GR1A of 1 Squadron, Royal Air Force, and a US Marine Corps AV-8A. The transfers are of good quality, but early kits have a fault on the red and blue fin flash for the RAF version, which is being corrected. I found difficulty in laying the fuselage RAF roundel down flat on the double curvature of the area around the engine intakes. Eventually it was found easier to match paints to the colours in the decals and paint the roundels by hand, using ink bow compasses filled with the respective colour paint to describe the circles. The upper and lower wing roundels on the transfer sheet were used without trouble, hence the need to match the paint colours accurately. The fault in the fin flash, which permits only one side to be used, necessitated painting this item by hand.

Incidentally, in the instruction sheet it is suggested that the exhaust nozzles should be painted "flat metallic grey". In fact, the forward nozzles, which only exhaust cold air, are painted dark green. The rear exhaust nozzles should be burnt metal.

Price of Revell's 1/32 Harrier is £1.70.

Matchbox's Strikemaster and Bell AH-1G HueyCobra

Two further Matchbox kits in 1/72 scale not previously reviewed are of the BAC 167 Strikemaster and the Bell AH-1G HueyCobra attack helicopter.

The BAC Strikemaster is a very welcome model and it is surprising that this aircraft has not been produced in a kit before now—although it would be equally surprising if one of the more established manufacturers does not release another Strikemaster kit before long.

An excellent choice of subject, Matchbox's kit is accurate, well-moulded and has an excellent fit of parts. The cockpit hood moulding is a beautiful piece of work. The external and cockpit detail is limited, and because the hood is so large and clear I think this is a case where a little more detail on such items as the ejector seats and the instrument panel would have been desirable. Detail is not so necessary where it is largely hidden. The nose landing light is also very prominent on the full size subject, and this is again an item that should have been detailed, with a separate transparent cover.

The underwing stores on this model are confined to the multi-tier single row of rockets under each wing. A feature of the Strikemaster is that it has four strong-points on the wing for the carriage of bombs, rocket pods, multi-tier rockets or drop tanks. I feel that a combination of loads should have been supplied with this kit, but their omission is not serious be-

cause such weapon loads can easily be taken from, say, the Airfix Jaguar or Harrier kits and adapted for use on this model. Four well-filled pylons added to this model make it look in character.

Adaption of this model to produce a Jet Provost Mk5 should be simple enough, by cutting off the wing tip tanks and adding ordinary wing tips, and by adding the strokes around the nose. There are several exciting colour schemes for Jet Provost Mk 5 aerobatic teams.

Transfers in the kit are for a Strikemaster Mk 80 of the Royal Saudi Arabian Air Force and a Mk 88 of the Royal New Zealand Air Force.

The New Zealand Strikemasters are painted in three-tone camouflage similar to that used by the USAF, whereas those in Saudi Arabian service are either camouflaged in dark earth and light stone on the upper surfaces or are aluminium overall. The transfers show variance from photographs of these aircraft and it is necessary to check the style and position of markings on actual aircraft before applying those supplied. One noticeable alteration required is that the words "Royal Saudi Air Force" should be on a white rectangle on camouflaged aircraft and this will have to be added to the model before application of the decal. As it is the decal is correct for an aluminium-painted aircraft.

Matchbox's Bell AH-1G HueyCobra is another useful subject for those wishing to depict a Vietnamese scene, and one that will probably appeal to the schoolboy market.

This model is generally accurate in outline and nicely moulded, but the indented skin lines are rather on the heavy side.

The tail rotor surprisingly appears to be mounted on the wrong side of the fin, photographs clearly showing this to be usually fitted to port. This can fairly easily be corrected.

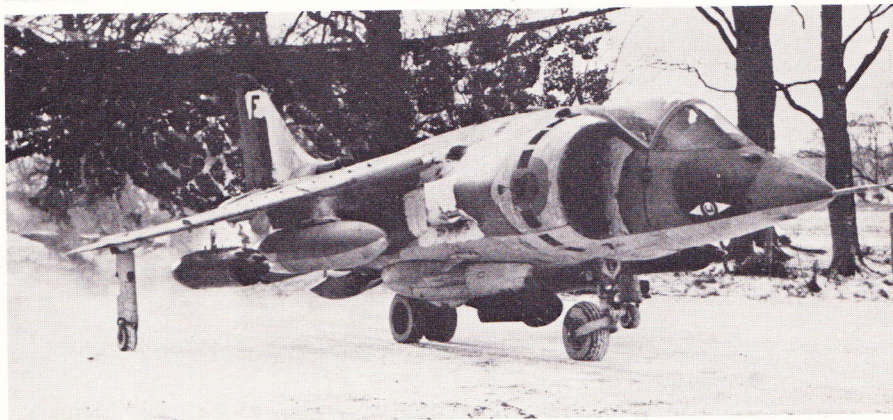
Gun pods and rocket launchers are provided for mounting on the stub wings and the gun barbette under the nose rotates. Cockpit detail is adequate and the glazed canopy is a beautiful piece of moulding. The rotor head is rather simplified, but the blade hubs are nicely detailed.

Transfers are provided for two versions: One is from the US Marine Corps and the other from No 235 Attack Helicopter Flight, US Army.

Each of these models costs 23p.

Above right: Four brand new Bell AH-1G HueyCobras on test prior to delivery to Fort Stewart, Georgia, for use in pilot transition training.

Right: Snow Harrier. A Harrier of No 1 Squadron in snow camouflage during Exercise "Sky Mist". See also centre-spread.

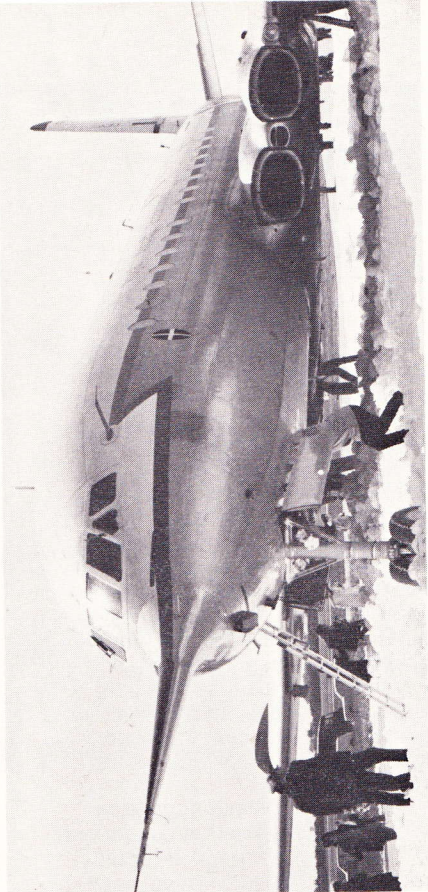
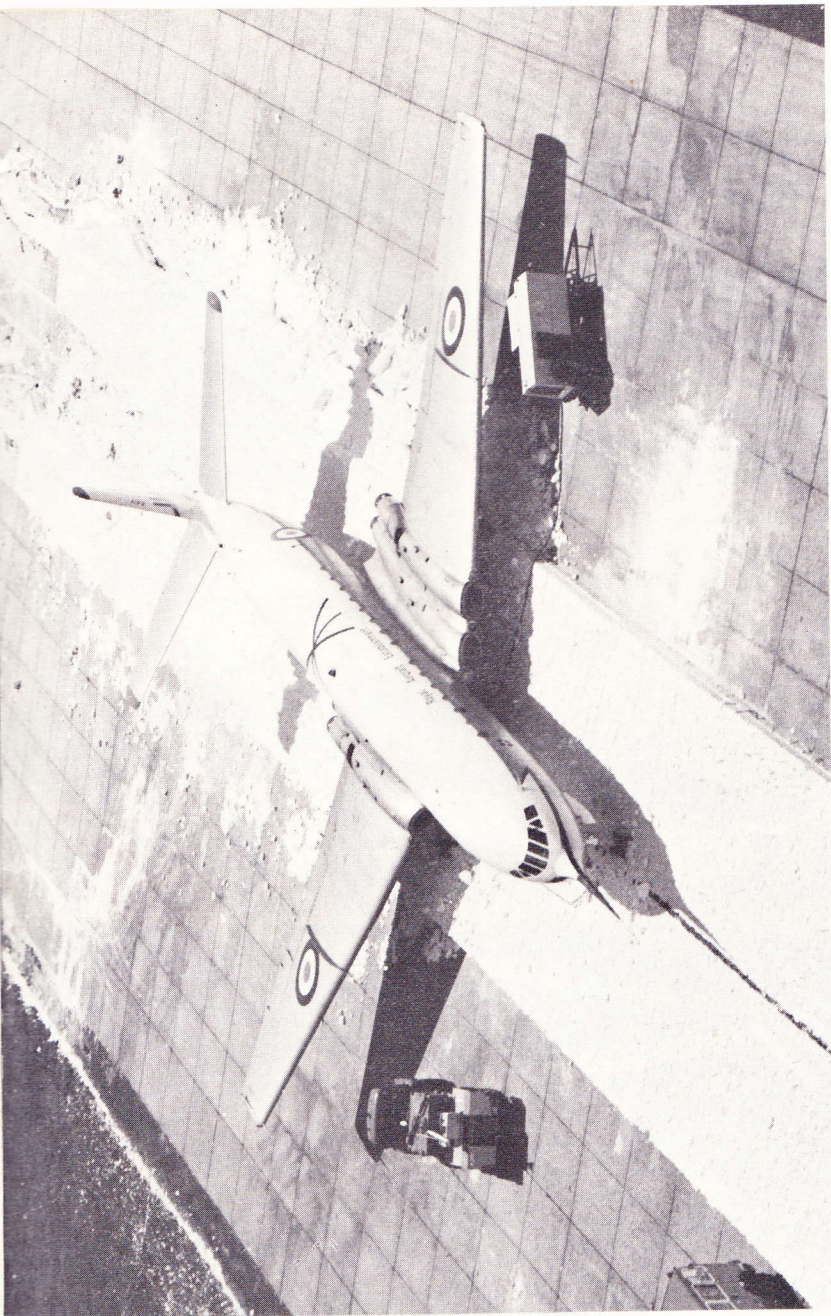




ARRESTED AT BEDFORD

Foamed plastic literally
paves the way to greater
airport safety

Photographs by Peter Hudson, RAE Bedford



Decelerating forces are independent of aircraft engaging speed. (iii) Ingestion of the foam by the engines causes no damage.

The experiments recently completed at RAE Bedford used a 300-ft long foam bed 36ft wide formed of two layers each 12 inches deep. A Comet 3B aircraft engaged this foam bed at an entry speed of 60mph and was arrested at a distance of 250ft. The dimensions chosen were not optimised for the Comet but were merely chosen to check the validity of the derived performance equations. The foam bed would, if used operationally at airports, be covered with a weather-proofed layer of fibre glass.

ON average throughout the major airports of the world excluding the Iron Curtain countries, some 15 incidents occur each year as a result of civil aircraft overrunning the ends of runways after an aborted take-off or faulty landing.

Many airports have runways terminating only a relatively short distance from hazards such as busy roads, railway lines, embankments and abruptly falling ground. The installation of an arrester such as a Soft Ground Arrester System in the overrun area of these runways for use in emergencies could therefore improve the operational safety of an airport and in many instances avert a possible major disaster.

Recently tested by the Royal Aircraft Establishment at Bedford, under the sponsorship of the Civil Aviation Authority, was a Soft Ground Arrester System using urea formaldehyde foamed plastic manufactured by British Industrial Plastics Chemicals Ltd, Oldbury, Worcester. This material, which is manufactured on site to a prescribed depth and strength, is pumped into position where it rapidly hardens becoming a permanent feature in the overrun area. The decelerating force for an overrunning aircraft is derived as an undercarriage drag force caused by the shearing and crushing of the foamed plastic by the aircraft wheels as they traverse the foam bed. The drag is proportional to the depth of penetration by the wheels which varies according to the aircraft weight and tyre size.

Theoretical studies have shown that a double layer foamed plastic arrester having an upper layer formed with a lower crushing strength foam gives the best overall performance. This arrangement allows both light and heavy weight aircraft to be arrested without overstressing the undercarriage. Advantages claimed for this material are

- (i) Performance is predictable, (ii)

Blackburn Shark

DEVELOPED as a private-venture prototype, the Blackburn B-6 Shark prototype two/three seat torpedo-spotter-reconnaissance (TSR) aircraft first flew in August 1933, and following successful Service evaluation trials 16 production aircraft, designated Shark I, were ordered for the Fleet Air Arm. The Shark I officially entered service in May 1935 with 820 Squadron aboard HMS *Courageous* replacing the squadron's Fairey Seals. This mark was followed by 126 Mk IIs and 95 Mk IIIs in turn, the latter featuring a glazed canopy over the cockpits. By 1938, however, the Shark was already obsolete and was relegated to other duties such as target towing, for which purpose many aircraft were equipped with a winch and wind-driven re-winding gear on the port side of the rear cockpit controlling a cable drum.

Six Shark seaplanes, designated IIA, were sold to the Portuguese Navy in 1935, three of them being fitted with a huge 160-gallon long range ventral fuel tank. The RCAF also adopted the Shark and, after purchasing seven Mk IIs from Blackburn, Canada arranged for 17 Mk IIIs to be built under licence in Canada by a subsidiary of the American firm of Boeing known as Boeing Aircraft of Canada.

Brief Specification (Shark I)

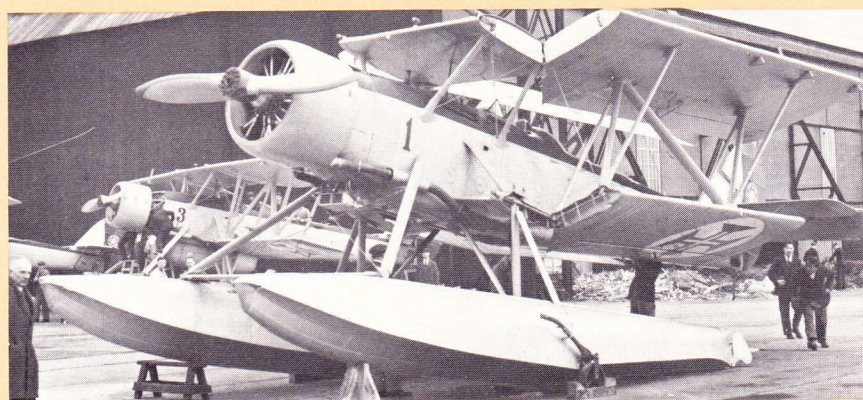
Power plant: One 700hp Armstrong Siddeley Tiger IV; **Span** (upper): 46ft, (lower), 36ft 0in, (folded) 15ft 0in; **Wing area:** 489sq ft; **All-up weight** (torpedo landplane): 8 050lb; **Speed at sea level** (torpedo landplane): 533mph; **Armament:** One fixed forward-firing Vickers machine gun and one Vickers-Berthier machine gun in rear cockpit. One 1 500-lb torpedo on crutches beneath fuselage or an equivalent weight of bombs on racks beneath wings.

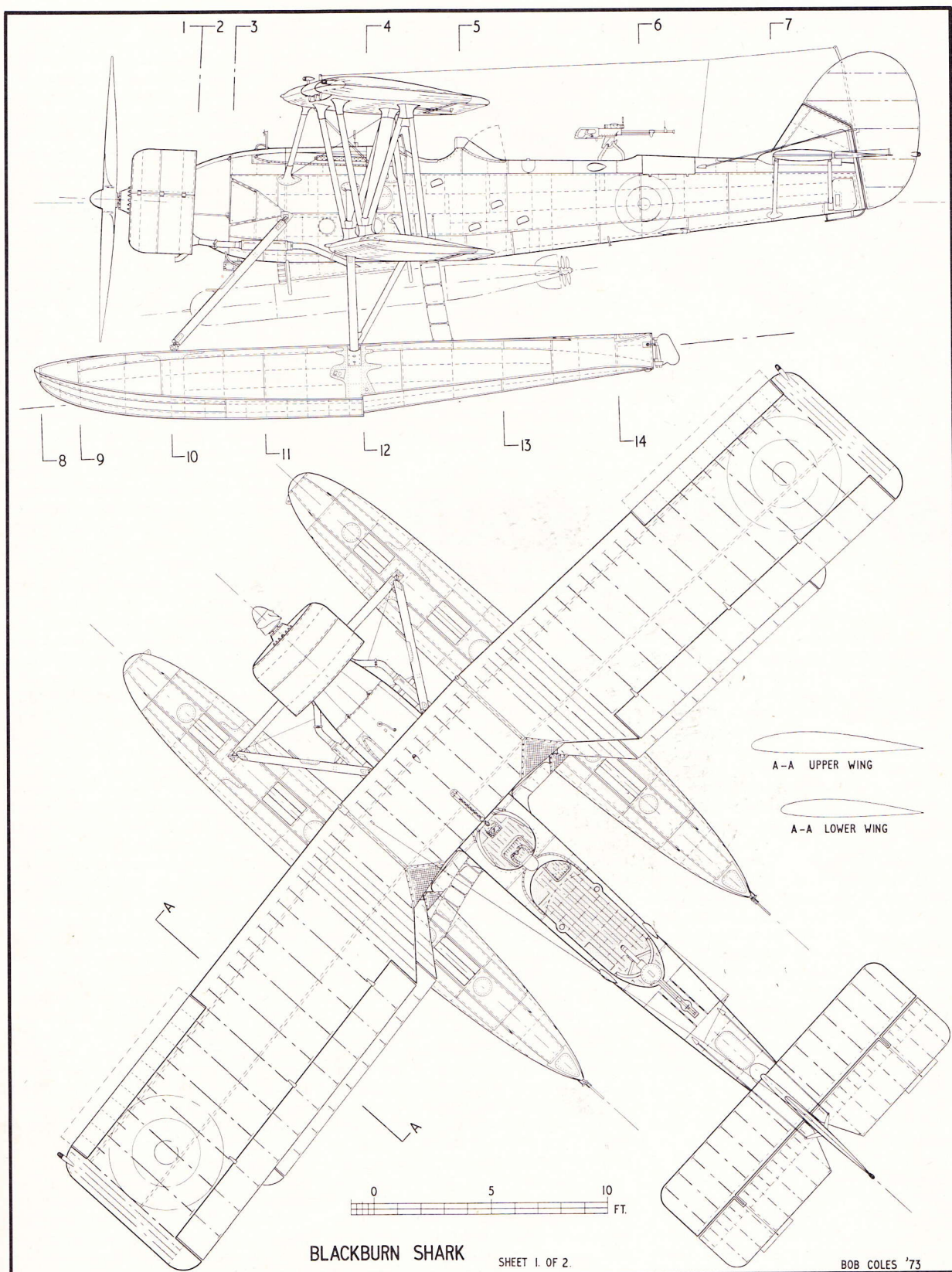
Top to bottom: The prototype Blackburn B-6 armed with a torpedo.

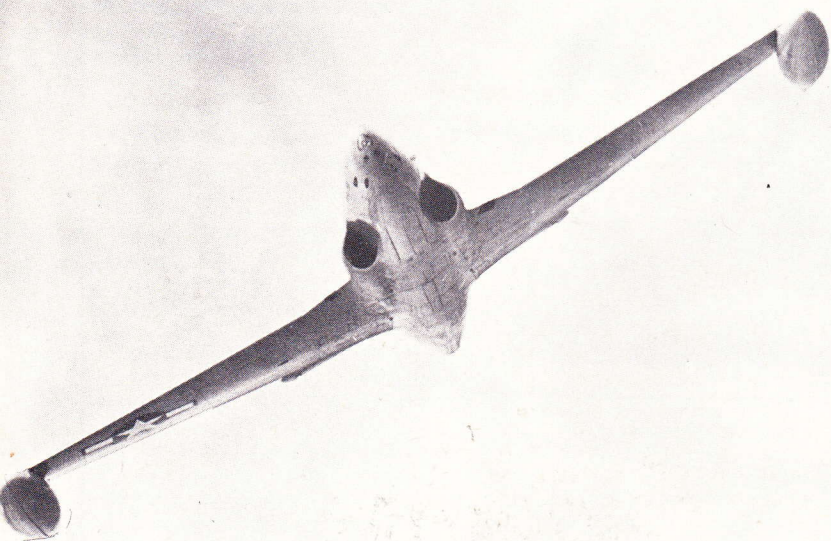
Third production Shark I in the markings of 810 Squadron. A Zippatone drawing of this particular machine, plus a head-on view to complement the drawings opposite, will appear in next month's issue.

The Shark III prototype.

First Shark for the Portuguese Navy at Brough in March 1936. Third aircraft, seen in the background, is fitted with a 160-gallon long-range ventral fuel tank.







SHOOTING STAR at war

The first jet aircraft accepted for operational service by the USAAF, the Lockheed F-80 (originally P-80) Shooting Star was just too late to see service in World War II but was on hand when the Korean conflict began in 1950 and was then given the opportunity to go into action for the first time. This account of some of its early operations is drawn from Robert Jackson's new book Air War Over Korea, to be published this month by Ian Allan Ltd.

ALTHOUGH the 374th Transport Wing's fleet of C-46s, C-47s and C-54s was standing by at Itazuke from dawn on July 1, 1950, plans for the rapid airlift of the 24th Division to Korea were initially hampered by bad weather. Six C-54s managed to get through to Pusan with their loads of troops during the afternoon, but then the weather deteriorated to such an extent that the major part of the operation had to be postponed until the following morning.

Then another problem arose; Pusan's primitive runway took such a pounding from the heavily-laden C-54s during the morning of July 2 that by now it was virtually unusable. Major-General Edward J. Timberlake, Acting Commander of the Fifth Air Force in the temporary absence of General Partridge, accordingly ordered the 374th Wing to continue the operation with

lighter, twin-engined C-46s and C-47s. The runway held, and by nightfall on July 4 the Wing had flown in the two battalions of the 24th Division, as well as the Divisional Headquarters and a Regimental Combat Team of the 21st Infantry Division.

All told, the airlift had proceeded with remarkably few hitches. In fact, it was one of the very few operations that did unfold with any reasonable degree of efficiency during this initial phase of the American commitment; activities during the first week of July revealed a regrettable lack of co-ordination at most levels, and it was to be some days—in some cases, weeks—before the machine began to function more or less smoothly.

Nowhere was this deficiency more apparent than in relations between the Army and Air Force. The vital importance of full ground-air co-operation, a lesson learned the hard way during the grim days of World War II, appeared to have been forgotten in the space of five short years. Military and air commanders quickly realised to their dismay that no firm plans existed either for the deployment of troops to Korea by air, or for the support of those troops by tactical aircraft once they entered combat; a formula for effective air-ground co-operation had to be thrashed out from scratch and in the meantime the American effort was sustained

largely as the result of personal initiative on the part of certain commanders. A good example of this was the decision taken by General Hoyt S. Vandenberg, the USAF's Chief of Staff, to authorise the immediate move of two medium bombardment groups—the 22nd and 92nd—to the Far East from their bases in the United States. Both these B-29 Groups belonged to the Strategic Air Command's Fifteenth Air Force, and although their transfer meant that SAC's striking capability would be temporarily depleted, General Vandenberg believed that he was justified in taking the risk. On July 8 the two groups—together with the 19th Bombardment Group and the 31st Strategic Reconnaissance Squadron—were formed into a Far East Air Forces Bomber Command at Yokota under the command of Major-General Emmett O'Donnell, Jr.

The lack of co-ordination was particularly apparent in the time it took to get messages from the ADCOM in Korea to the Advance Headquarters of the Fifth Air Force at Itazuke. Requests for air support of any kind had to follow a tortuous route through GHQ in Tokyo and FFAF before they finally reached Itazuke; and delays of up to four hours, even involving urgent messages, were normal.

On July 4, in a determined effort to overcome this ridiculous situation, General MacArthur ordered the establishment of a new ground command; United States Army Forces in Korea (USAFIK), under the command of Major-General William F. Dean. The latter was ordered to by-pass the usual circuitous channels and communicate directly with the Commanders of FFAF and Naval Forces Far East whenever he needed air and naval support. The next essential step was the creation of a joint operations centre; this opened on July 5 in Taejon, and consisted of two operations sections, one run by the Air Force and the other by the Army. Their function was to collate and co-ordinate all available intelligence; actual control of tactical air power was to be exercised by a tactical air control centre, operating in close conjunction with the Joint Operations Centre. In these early stages, however, the JOC was run almost entirely by Air Force personnel—some 45 in all, under the command of Lieutenant-Colonel John R. Murphy—and there was little in the nature of a joint enterprise about it. The situation at the battlefield was so confused that it was almost impossible to draw an accurate intelligence picture, and, because the communications problem was still far from solved, such

information as was available was more often than not out of date by the time it filtered through to Fifth Air Force Advance Headquarters at Itazuke.

By the end of the first week of July, it was apparent that the plan to stiffen the resistance of the ROK forces with the aid of the 24th Infantry Division had failed. Lightly armed American infantry, outnumbered by ten to one, lacking supporting artillery and armour, were no match for the North Koreans' T-34 tanks. On July 6 the American forces, dazed and bewildered by the battering they had received, were in full retreat towards Chonan. This position also had to be evacuated less than twenty-four hours later; the situation was now extremely critical, and General MacArthur expressed his fear to the joint Chiefs of Staff that unless more American combat units could be rushed to Korea with the least possible delay the Allies might not be capable of holding the Pusan perimeter. Tactical air power was now the only trump card the Americans had left, and they were prevented from using even this to the fullest advantage by the ever present problem of range.

It was an unfortunate handicap, for the North Korean People's Army—strung out as it was in long convoys along the country's roads in its head-long drive southwards—was extremely vulnerable to hostile air attack. The North Koreans appeared to be completely unaware of the havoc that could be wrought by ground attack aircraft or else they chose to ignore it; more often than not, when American fighter-bombers appeared, the enemy infantry—instead of diving for cover—stood up in their trucks and fired back with every available weapon. American pilots seldom returned from a mission without reporting some success against enemy ground forces. Among the most successful of all were the crews of the 3rd Bombardment Wing, whose B-26s carried sufficient fuel to permit a leisurely reconnaissance of enemy territory and selection of the most likely-looking targets.

A good seventy per cent of all combat missions over Korea during the first two weeks of July, however, were flown by the Fifth Air Force's F-80 Shooting Stars. Although they had next to no experience in ground attack techniques the F-80 pilots quickly built up a high degree of proficiency in their unaccustomed fighter-bomber role, particularly in the use of the 5in high velocity aircraft rocket (HVAR) against the enemy armour. Each Shooting Star could carry up to sixteen of these projectiles in addition to its

primary armament of eight 0.5 machine guns. The Fifth Air Force pilots were unanimous in their praise of the F-80 as a ground attack aircraft; the high speed gave it the all-important element of surprise, and because there was no propeller torque to cope with it was a far better gun platform than any conventional propeller driven machine.

The F-80C could also carry a pair of 1 000lb bombs in place of its 165 gallon tip tanks, but this reduced its radius of action to approximately 100 miles. Normally, with a full fuel load and sixteen rockets the radius of action was 225 miles; in this configuration the aircraft had a loiter time over the target of something like fifteen minutes. It was not enough, and General Partridge—conscious of the fact that a few more minutes in the target area would double the F-80s success rate—gave the 49th Fighter-Bomber Wing the task of working out some kind of solution.

It was not long before the 49th's engineer officers came up with an answer. They found that the two centre sections of a Fletcher fuel tank could be fitted into the middle of the standard Lockheed tank carried by the Shooting Stars, creating a longer tank capable of holding 265 gallons of fuel. Tests showed that the F-80 was quite capable of carrying the modified tanks, and although there were fears that the heavier load would overstress the aircraft's wing tips, Far East Air Force ordered manufacture of one pair of tanks for every Shooting Star in the Far East Command to go ahead. About twenty-five per cent of the Japan-based F-80 units had received the modified tanks by the end of July, and pilots now found that they were able to spend up to forty-five minutes in the combat area.

The problem of range and endurance would have been overcome far more satisfactorily had the Fifth Air Force's F-80 groups been able to re-equip with the more modern Republic F-84E Thunderjet, a type which—in 1950—equipped a large proportion of the USAF's fighter-bomber units. With its ability to carry up to 32 HVAR rockets, coupled with a combat radius of 850 miles, the F-84E would have more than adequately fulfilled the Fifth Air Force's ground attack requirements in Korea; the only thing that prevented its operational deployment in Japan was the inadequacy of the Japanese airfields themselves, only four of which had the 7 000-foot runways necessary for the safe operation of aircraft of this type. For the time being, the Shooting Star—with all its inadequacies—was

the most advanced combat aircraft the Fifth Air Force was capable of handling.

A request for an additional 164 F-80Cs, in fact, headed the list of urgent aircraft requirements sent to Washington by General Stratemeyer on June 30. The list also included an additional 64 F-51 Mustangs and 21 F-82s, both of which types were eminently suitable for long range ground attack work. The Mustangs were to be used to build up a new fighter-bomber group, which was to be based at Iwakuni; meanwhile General Stratemeyer ordered the Thirteenth Air Force to form an F-51 Squadron at Johnson Air Base with the aid of thirty Mustangs pulled out of storage. All the other aircraft on Stratemeyer's list were needed for existing FEAF units, some of which were seriously under strength; a second requirements message, dated July 1, requested the immediate despatch to Korea of one Medium Bombardment Wing, two Mustang Wings, two F-82 all-weather Squadrons, a B-26 Wing and finally two B-26 Squadrons to reinforce the 3rd Bombardment Wing. A few days later the requirement was extended to include an RF-51 Reconnaissance Squadron, an RB-26 Night Photographic Reconnaissance Squadron and a Tactical Air Control Squadron.

Meeting these requirements, however, presented a major problem. For a start, F-80C Shooting Stars were in short supply, and although there were more than 300 F-80As and F-80Bs that could be brought up to C standard by Lockheeds, this could only be done at a rate of 27 a month. Also the USAF was totally unable to meet the requirements for additional F-82 Twin Mustangs; there were only 168 of these aircraft in USAF service, and this fact—together with a critical shortage of spares—prevented any hope of making good combat attrition suffered by the Fifth Air Force's F-82s in combat over Korea. As far as the F-51 Mustangs were concerned, the position was a little rosier; 764 of these aircraft were in service with Air National Guard units, and a further 794 were in storage. Upon receipt of Stratemeyer's requirements list 145 F-51s were recalled from the Air National Guard, and made ready for shipment to Korea aboard the aircraft-carrier USS *Boxer* together with their pilots and ground crews. The plan was to deploy a proportion of these aircraft on the South Korean airfields as soon as possible after their arrival in the Far East.

Before this deployment could take place, however, steps would have to be taken to remedy the deplorable con-

dition of the South Korean airfields still held by the Allies. In July 1950 the only South Korean airfield suitable for operations even by piston-engined combat aircraft was Taegu, and even that had little to offer; the runway was a bumpy pilot's nightmare of packed earth and gravel, and amenities consisted of a few ramshackle buildings. Since June 30 Taegu—known also under the military designation of K-2—had been the home of the ten worn-out Mustangs supplied to the Republic of Korea on the request of President Rhee. This unit, manned by a mixed bunch of South Korean and American pilots under the command of Major Dean Hess, was in action almost continually during the early days of July, although its effectiveness was hampered by the fact that many of the South Korean pilots lacked sufficient experience to handle the F-51 and also by the lack of a suitable tactical air control system.

Meanwhile, there were indications that the Communists were at last beginning to feel the effect of the growing weight of air power that was being directed against them. This was apparent in the fact that they were forced to rest and regroup after the capture of Chonan on July 8; had they been able to push on immediately, they might well have succeeded in rolling up the remnants of the 24th Division and annihilating them. Since July 2, the Fifth Air Force's fighter-bombers had been joined by naval aircraft from the carriers USS *Valley Forge* and HMS *Triumph* on station in the Yellow Sea. The *Valley Forge* and her escorts formed a fast carrier striking force, known as Task Force 77, the offensive power of which had virtually been doubled with the arrival of HMS *Triumph* from Hong Kong on June 30, together with two cruisers, two destroyers and three frigates.

The carrier aircraft—Corsairs and Skyraiders from the *Valley Forge* together with Fireflies and Seafires from *Triumph*—launched their first strikes of the war on July 3. For two days they pounded the Communist airfields at Pyongyang and Onjong-ni, and in addition to the damage inflicted on ground installations, naval pilots—Lieutenant J. H. Plog and Ensign E. W. Brown, flying F9F Panthers of VF-51—shot down two Yak-9s and damaged ten other Communist aircraft on the ground.

The naval air strikes against the Communist airfields early in July heralded the start of a determined effort by the United Nations to eliminate North Korea's small air force once

and for all. The importance of such a step was underlined on July 10 when four Yak-9s attacked elements of the United States 19th Regiment near Chongju and inflicted some casualties. The following day, more Yaks attacked a flight of F-80 Shooting Stars engaged in strafing ground targets in the same area, and the American pilots—short of fuel—barely managed to escape unharmed. This incident was repeated the following day, near Chochiwan; once again the American pilots were able to get away, but a B-29 of the 19th Group, engaged in bombing railway targets near Seoul, was not so lucky. It was trapped by three Yaks, and after a brief one-sided encounter was shot down in flames. A small L-4 liaison aircraft was also destroyed by a pair of Yaks towards the end of the day. On July 15 two more Yaks came up to intercept a flight of four B-26s over Seoul; they harried the bombers for ten minutes with a series of determined attacks, severely damaging one of them.

American Intelligence indicated that seven or eight Yaks were operating out of Kimpo, and in the afternoon of the 15th, on the orders of General Partridge, this was attacked by a flight of F-80s. Later in the day Kimpo was also bombed by three B-29s. The majority of the Communist aircraft, however, were reported to be concentrated on the airfields of Pyongyang and Yonpo, and on July 18 and 19 these were the targets of the carrier aircraft of Task Force 77. In two days of operations, the naval pilots claimed a destruction of 32 enemy aircraft on the ground, together with thirteen damaged. Also on the 19th, seven F-80s of the 8th Fighter-Bomber Group launched a concentrated strike on the satellite airfield near Pyongyang, destroying fifteen aircraft in one whirlwind firing pass. The next day, fourteen B-29s followed up these strikes by bombing the runways of the Communist airfields clustered around Pyongyang. During this same period—between July 17 and 20—F-80 pilots of the 8th Group also destroyed six enemy fighters in the air to air combats over the front line.

By July 21, although the NKAf had still not been totally destroyed, it had become almost completely ineffective as a fighting force. Wherever reconnaissance located enemy aircraft, they were immediately neutralised by air strikes. By August 10 allied pilots had claimed the destruction of 110 Communist aircraft in the air and on the ground. There was some doubt as to the validity of this figure, for it was known that some of the enemy aircraft

claimed as destroyed had in fact been dummies deployed by the Communists on their airfields; nevertheless the absence of the North Korean Air Force in combat during the first week of August indicated that the enemy had, to all intents and purposes, been knocked out of the fight. Communist aircraft did in fact continue to put in an occasional appearance—on August 15, for example, a solitary La-7 attacked a B-29 of the 307th Bombardment Group without inflicting any damage—but such incidents were few and far between.

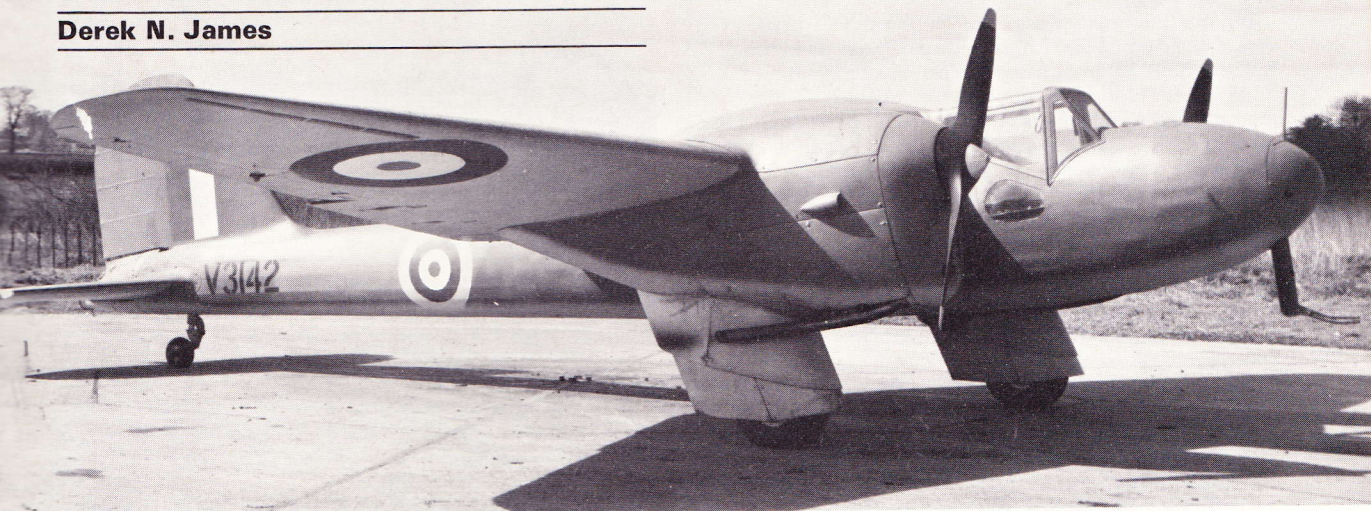
The elimination of the NKAf meant that the FEAF's medium bomber groups could now range freely over the whole of North Korea without fear of interference from hostile aircraft. The first strategic mission of the newly constituted Far East Air Forces Bomber Command had been flown on July 13, when B-29s of the 22nd and 92nd Bombardment Groups bombed the marshalling yards and oil refinery at Wonsan, through cloud with the aid of radar. The number of strategic missions of this kind was stepped up during the remainder of July, as the increasing successes of the Fifth Air Force's fighter-bombers against the advancing Communists enabled more medium bombers to be diverted from the tactical support role, a task for which they were totally unsuited.

Although the Japan-based fighter-bombers of the Fifth Air Force were already inflicting great devastation on the North Korean columns by the end of the second week in July—on July 10, for example, a convoy of 150 enemy vehicles was wiped out near Pyongyang in a massive air strike by B-26s, F-82s and F-80s—the real turning point in the air-ground offensive came in mid-July, with the establishment of the Mustang-equipped 51st Fighter Squadron at Taegu. This squadron, which also absorbed the battle-weary surviving aircraft of Major Dean Hess's composite South Korean/American Unit, flew its first ground attack mission on July 15.

Meanwhile Air Force engineers had been working flat out to extend the runway facilities of an old wartime Japanese airfield near the town of Pohang, on the east coast of Korea. Their work was completed by July 14, and two days later the Mustangs of the 40th Fighter-Squadron flew in from Ashiya. This squadron was the first Fifth Air Force Unit to exchange its F-80 jets for piston-engined F-51s, and the pilots had completed their conversion to the older type in record time.

The Boulton Paul P92 & P92/2

Derek N. James



AVIATION, like viniculture, has both vintage and non-vintage years depending upon the degree of success achieved by aircraft manufacturers and operators. The year 1937 can be regarded as vintage, particularly for the variety and interest of the specifications of that year. Judgement on its success would have varied, however, depending upon whether one viewed it from the standpoint of General Aircraft whose GAL38 Fleet Shadower to Air Ministry Specification S.23/37 was one of the "all time greats" in the ugliness stakes; or Gloster Aircraft busy planning twin-engined fighters to F.9/37; or Blackburn Aircraft (whose elderly Shark torpedo bomber was produced to Specification 31/37 in Canada by Boeing) who was busy putting a four-gun turret in a Skua to Spec O.15/37 to produce the Roc naval fighter, and then fitting it with float alighting gear to meet Spec 20/37.

For Boulton Paul Aircraft at Wolverhampton, however, 1937 was a vintage year for several reasons. The prototype Defiant turret-armed fighter first flew on August 11 and the Defiant Mk I was ordered into production later in the year to Specification F.5/37 (and who could foresee the events of June and July 1940?). Of particular interest to this company was the issue, on May 26, of Specification F.11/37 to cover the requirement for a two-seat day and night fighter for home defence and to operate with a field force.

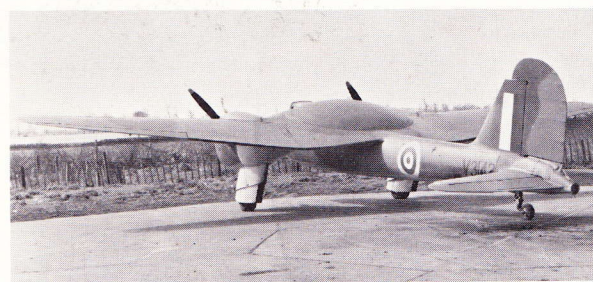
While the Defiant was the major preoccupation of the company's production and flight test departments, John D. North, Boulton Paul's General Manager and Chief Engineer, was concerned with preparing a submission to meet this challenging specification.

He was not alone; five other companies were similarly preparing F.11/37 projects. They were Hawker, Supermarine, Armstrong Whitworth with a twin "pusher" Merlin-powered design, Bristol and Shorts.

Intended as a counter to fast hostile bombers, the emphasis of this requirement was on a very high top speed and heavy armament. Four 20mm Hispano cannon in a power-operated turret, to provide protection for the gunner, were specified with the cannon being capable of being fired through 360 degrees of azimuth—including straight ahead—and with large angles of elevation and

depression. The gunner was to have an unimpeded view of the upper hemisphere for effective search and gun firing, and his field of view was to exceed that of the field of fire. His seat was to be coupled to the turret and rotate with it and to have at least four inches vertical adjustment. In addition to the four-cannon turret the aircraft had to carry internally a 2 500lb bomb load to break up hostile bomber formations.

The pilot was to have an adjustable seat and rudder bar, full night flying equipment was required and electric starting was specified for the engines. The cockpit was to have easy emergency escape facilities, a good field of vision for night flying and be fitted with a blind flying hood. Good manoeuvrability and low speed handling characteristics were mandatory plus the ability to be a steady gun-firing platform. A maximum speed of 370mph at 35 000ft was required, together with a 320mph cruising speed at this height and the ability to maintain 15 000ft altitude on one engine. The design was to be



Top: The Boulton Paul P.92/2 half scale flying version of the projected P.92 turret-armed fighter. Noteworthy in this view are the leading edge slots and the small clear view panel in the fuselage sides to assist downward and sideways vision.

Above: This view of the P.92/2 clearly shows the large diameter turret mounted in the centre section. The four cannon armament was not simulated in the wooden turret.

such that the airframe could be produced rapidly on a dispersed basis and engine changes could be accomplished within two hours.

The Big Turret

Boulton Paul's submission to Specification F.11/37 was dated August 1937 and the project was designated P.92 in the company's design series. Drawing No. X1576/T (unfortunately not clear enough for reproduction—ED) shows what, at first, appears to be a fairly conventional shoulder-wing monoplane of clean design with a very slim fuselage, a single fin and rudder and powered by two 1 760hp Rolls-Royce Vulture engines driving three-blade propellers. Further examination, however, reveals that the centre section "has been thickened and so developed that a portion of the top surface forms a solid of revolution and is used to form the turret main cupola. A secondary small transparent cupola is fitted . . . for general observation and sighting purposes".

The 13ft diameter low drag turret was intended to be fitted between the wing spars which enabled this turret, necessarily large to accommodate the four big cannon, to be housed internally without the need for a large fuselage, cupola or retracting mechanism. Being located near to the aircraft's centre of gravity, it was in the best possible position for dealing with the imposed loads. With the cannon depressed near to the wing surface the large diameter turret would have almost completely covered the barrels and thus reduced the induced drag, while shutters, operated by the cannon elevating gear, covered the slots in the turret itself to present a clean surface to the slipstream.

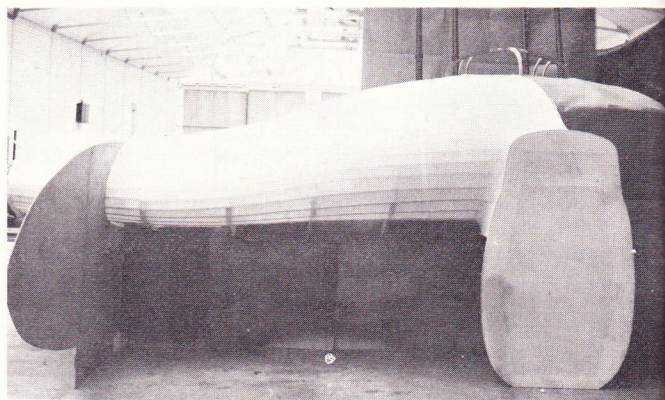
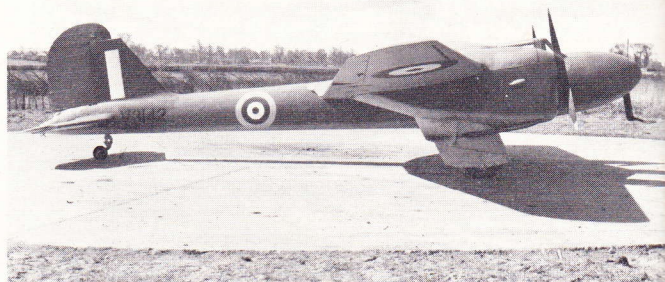
Boulton Paul carried out model tests in its own 4ft windtunnel on a 1/20th scale model and found that the drag of the centre section and turret was well within acceptable limits.

Metal skin construction with interchangeable units adapted for machine riveting and spot welding, was envisaged. The 52ft 3in long fuselage was of monocoque construction and was to have been built in five bolted-together portions; the front fuselage and cockpit, the centre fuselage, the rear fuselage built in two lateral halves, the complete tail unit and the tail fairing. The 62ft 6in span wing was simply a centre section and two outer panels carrying split-type flaps and Frise ailerons with trim tabs. A heavy gauge ring stiffener was provided in the centre section between the spars to form a rigid base for the turret. Lockheed hydraulically-operated landing gear, with all three units being retractable, was specified.

Two 1 710hp Rolls-Royce Vulture S 24-cylinder X liquid cooled engines were chosen initially for the P.92 "because they enable the desired performance to be achieved and make a clean installation possible". Fitted with "rams horn" type ejector exhausts, the Vultures were to have driven 13ft diameter three blade de Havilland Hamilton Standard (sic) variable pitch propellers.

Crew Comfort

The general layout provided for "the comfortable accommodation of both crew members . . . for efficient operation and minimum fatigue". The design embodied an enclosed and sound-proofed pilot's cockpit with sliding canopy, which was located ahead of the propeller discs in the front fuselage to give a good all-round view, particularly forward and downward. Full cockpit instrumentation was provided for, including a blind flying panel, although a detailed panel layout was not



Top: Although the two Gipsy Major engines obscured more of the pilot's view sideways than would have the Vultures in the full-sized aeroplane, there is no doubt that the P.92 pilot's vision would have been restricted.

Centre: The very slim fuselage and swollen centre section are very apparent in this head-on view of the P.92/2 on the compass swinging bed at Boulton Paul's Wolverhampton factory.

Above: Mockup of the P.92's centre section and turret in Boulton Paul's Experimental Department. Note the small cross sectional area of the fuselage, the silhouette of the starboard Vulture engine and the four cannon shown at maximum elevation.

produced. Hot air from behind the radiators was to have been pumped into the cockpit and turret using electrically-driven fans. An adjustable seat, with arm rests, and an adjustable rudder bar were specified. In an emergency the pilot would have baled out of the P.92 either in the orthodox manner, after jettisoning the canopy, or by tilting his seat backwards through 110 degrees and sliding headfirst on his back through an emergency hatch in the fuselage. Operation of the catches to allow the seat to tilt in this manner also opened the hatch doors. Boulton Paul's test pilots recommended this latter method of making an emergency exit in view of the proximity of the propellers to the cockpit. It is reported that J. D. North, in his zeal to try this means of escape, tilted the seat in the mock up and was unceremoniously dumped head first through the hatch onto some sacks on the floor beneath the fuselage!

General equipment detailed in this submission included an oxygen supply for the pilot and gunner, a TRX.14 radio set, night flying equipment including wing-mounted landing lights and tubes for launching flares, a Graviner fire extinguishing system in each engine nacelle, anti-icing and turret ventilation to clear fumes after the cannon had been fired.

Most of these design features were to have been expected in a high performance aeroplane of that period; it was, however, the heavy armament and the turret which made the Boulton Paul P.92 unique.

Below: The P.92/2 airborne. Note that the roundels on the wings and fuselage and the fin flash have been altered to conform to the camouflage and markings of the period and that the fuselage carries the yellow prototype letter.

Turret Design

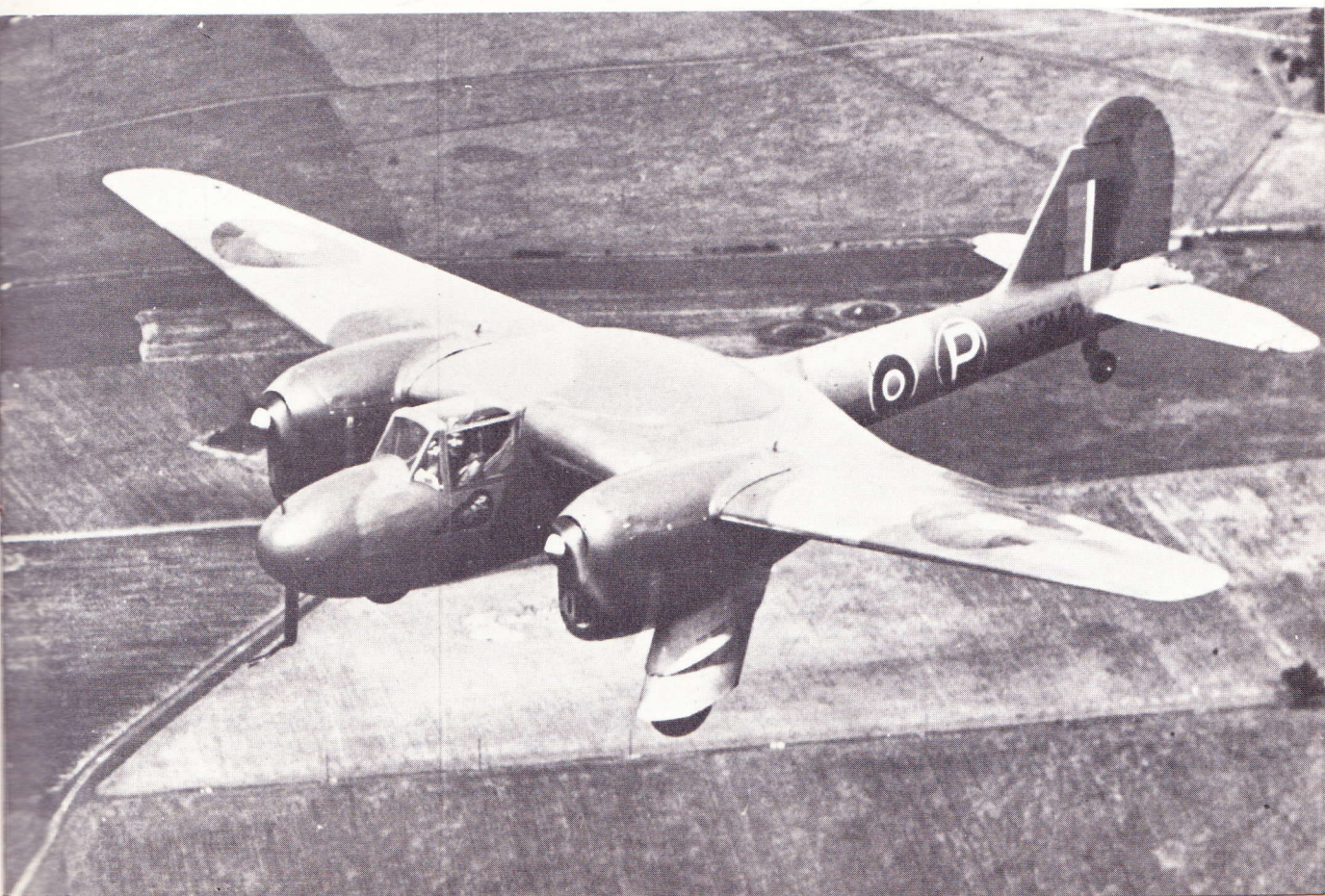
The gunner was seated comfortably in the centre of the turret under a small transparent cupola. The four 20mm Hispano cannon were mounted side-by-side and were designed to be attached to a shock absorbing mechanism fixed to a large diameter crankshaft carried in bearings on the main mounting plate. Boulton Paul earlier had built a turret for one 20mm cannon using this shock absorbing system, which had been fired and found satisfactory by the Hispano company.

The design made provision for 120 rounds per cannon (four drums of 20 rounds each) to be carried. Spare drums were carried on rails in the turret roof and could be slid into position on the breech end of the cannon. This relieved the gunner of the problems of lifting the heavy drums from storage racks.

The main turret was designed to be built up from braced ribs covered with a light alloy skin. It would have been power operated by an electro-hydraulic system already proven in earlier Boulton Paul turrets but modified to cope with the heavier loads involved. A rotating brush gear was to have been provided at the turret base for taking electrical power, and other electrical services, into the turret. The whole structure was designed to be attached to a main turret ring and to a secondary outer ring to deal with slight structural deflections.

Cannon firing was by the standard pneumatic method, and special electrically-operated valves through an interrupter device prevented the propellers and fin being shot away.

The smaller upper cupola was a Perspex moulding attached to a rotating ring by simple clamps which could be released quickly for emergency jettisoning. The gun





Above: Wooden mockup of the P.92 turret before the plywood covering was attached. Spare ammunition drums can be seen between the wooden frames at the left of the picture and one drum is being moved along its mounting rail toward the cannon breech.

sight was mounted on the same ring. Azimuth correction was applied by rotating the smaller cupola relative to the main turret. The whole turret was a self-contained unit requiring only the removal of the main holding down bolts and disconnection of the electrical brushes for rapid removal from the aircraft.

Boulton Paul's submission ultimately was chosen from among the six F.11/37 contenders and a contract for three prototypes was placed in March 1938. The first of these prototypes was to have been powered by 1 760hp Rolls-Royce Vulture II 24-cylinder X liquid cooled engines, the second by 2 055hp Napier Sabre I 24-cylinder horizontally opposed I liquid-cooled engines and the third, which was intended for armament and turret development trials, was to have had Vultures. At an all-up weight of 17 697lb the Vulture-powered P.92 variant was expected to have had a top speed of 371mph at 15 000ft and a cruise speed of 320mph at this height, at which, also, the maximum rate of climb of 3 220ft per min was achieved. Service ceiling was calculated to be 38 000ft with a 23 000ft single-engine ceiling. Take-off run with 30 degrees of flap was 260 yards at a speed of 79mph, landing distance over the 50ft screen was 190 yards at a landing speed of 82mph. With 270 gallons of fuel the duration would have been around 1½ hours allowing for 15 minutes full power at sea level.

These, then, were the plans and dreams for an unusual and exciting aeroplane. Reality, initially, was far less exciting even though the concept was sound enough. In order to establish and assess the aerodynamic characteristics of the projected P.92 fighter the design of a half-scale flying version was prepared. Because Boulton Paul's factory was almost wholly concerned with production of Defiants the manufacture of this aeroplane was passed to Heston Aircraft.

The Wooden Mini

Designated P.92/2 it was of all wood construction with a plywood monocoque fuselage and ply-covered wings. The rudder was fabric covered but all other control surfaces were of wood. Metal was used for cowlings the two 130hp de Havilland Gipsy Major II six-cylinder in-line air-cooled engines—which drove two blade fixed pitch propellers—for the nose cone, the fairings of the fixed

landing gear and for a number of access panels and fairings at the tail including that over the anti-spin parachute. Like the full sized design the P.92/2 featured the large low drag turret in its centre section. Built of wood, it lay almost flush with the upper surface of the wing but the four cannon armament—even in half size—was omitted. Normal all-up weight of the aeroplane was 2 716lb.

Design work was stabilised in mid-1939 and construction of two P.92 prototypes began at Wolverhampton while construction of the P.92/2 got under way at Heston. Work at both factories proceeded well but during March 1940 the Air Staff decided to rationalise the aircraft industry's design and development work and concentrate its facilities on fewer types. Thus, on May 26, even while some detail design of the half scale version was still in progress, the F.11/37 project was cancelled with about 5 per cent of the two prototypes' structure already completed. It was decided, however, to proceed with the P.92/2 and during the spring of 1941 this aeroplane was readied for its first flight from Heston piloted by Flt Lt E. Feather, Boulton Paul's chief test pilot.

One problem inherent in scaled down aircraft is that of accommodating full scale pilots and thus little more than a back rest was provided in the P.92/2 for the pilot who sat on his fighter type parachute pack. The canopy, too, could not be of the sliding variety but had to be fitted and removed by the ground crew before and after flight.

Following some preliminary and satisfactory initial handling and familiarisation flights the P.92/2, serialised V3142, was flown to Boulton Paul's Wolverhampton factory where the upper centre section and the turret were tufted and pressure pick-off tubes were installed. With this equipment V3142 undertook a programme of flying to determine the effect of the large turret on performance and other aerodynamic qualities. In June 1943 the P.92/2 moved to the Aircraft and Armament Experimental Establishment at Boscombe Down where, during the following month, it underwent flight trials. Report 812, issued on August 25, confirms the discomfort of the cockpit of V3142 which was described as "long, narrow and cramped". It could be entered only with the engines stopped and then only with the aid of steps. However, once in the air, the handling characteristics were considered to be pleasant but both the ailerons and flaps came in for some criticism. Lateral control was inadequate and additional area was called for on the three-section trailing edge flaps to steepen the very flat glide angle. The view forward and upward to the rear was considered to be good but sideways and downward the engines obscured the view almost completely. In the full sized aircraft this latter point would not have been so apparent although the view would not have been very good. The noise from the comparatively small Gipsy engines was not unduly obtrusive but Boscombe Down pilots were of the opinion that in the P.92 the proximity of the two 2 000hp engines and their exhausts would have presented some noise and fatigue problems. This is understandable as the inboard exhausts of the Vulture would have been only a little more than 5ft from the pilot's ears!

The earlier cancellation of the F.11/37 ended the need for further flight trials of the P.92/2. Its ultimate fate is uncertain but it is reported that it was flown back to Boulton Paul and there broken up in the latter months of the war.

PHOTOFILE

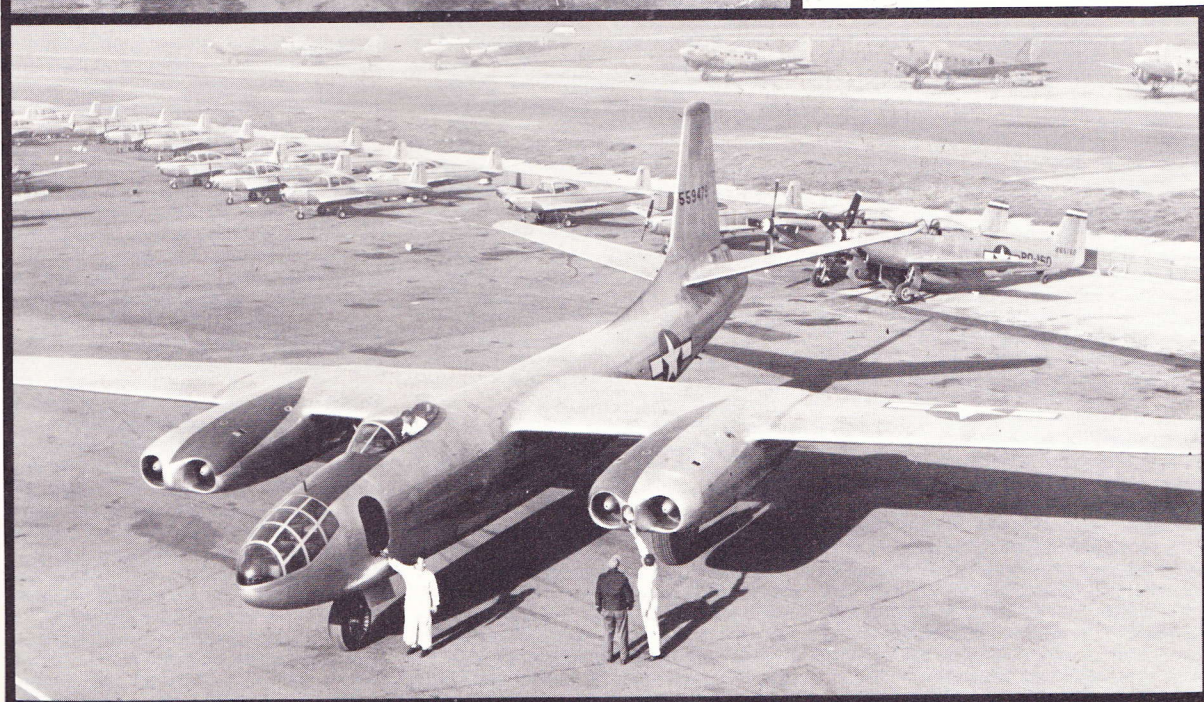


Above: An Avro Tutor at A & AEE, Martlesham Heath, for trials.



Left: Fairey IIIIC G-EARS ex N9256 at Hamble following its return from Canada where it was registered G-CYCF.

Below: First American jet bomber to fly (on March 17, 1947, from Muroc)—the North American XB-45 Tornado prototype, 45-59479. Behind the tail can be seen the first production Twin Mustang, P-82B 44-65160, buzz number PQ-160



AIRVIEW

A monthly look at the home aviation scene

Peter R. March

Away from it all?

At last a couple of weeks to break away from the busy summer round of air displays, briefings and visits to Service establishments. As usual mid-August is a quiet time and rightly peoples' attention has turned to holidays. Surprisingly the weather is hot and sunny and even the cool water of the English Channel is inviting after an hour on the baked sand of the Dorset coast. A skyward glance as a familiar drone rises above the growl of power boats and there, winging down from the sun like a quartet of SE5As over the battlefields of France, the unmistakable Pitts S2As of the Rothmans team. For the following quarter of an hour they entertain the unsuspecting public with their fantastic manoeuvres, all the more spectacular as the white smoke trails contrast against the blue sky. Manx Kelly and his team have reached a peak quite unsurpassed by any other civilian aerobatic team, aided of course by the splendid little Pitts S2A, big brother of the Pitts Special. Throughout the summer months they are not only giving performances at air displays up and down the country but, like the *Red Arrows*, at many seaside resorts around the coast.

Along certain stretches of the south coast, of which Dorset is no exception, there is a good deal of interesting aviation activity. On one afternoon no less than seven different types of helicopter were seen at low level over the west of the county—Sea King, Wasp and Wessex 1, all from Portland; Enstrom, Jet Ranger and Sioux/Bell 47g probably all civil; and a Lynx from Yeovil using Lyme Bay for hovering trials. The low-level route which comes inland near Swanage produced a miscellany of military types, ranging from Vulcan and Buccaneer to Hercules and Andover, while the appearance offshore of Canberras, Sea Vixens and Hunters showed that the FRADTU at Yeovilton was active. It seems you never really can get right away from it all!

Army Air Corps developments

At present the Army Air Corps consists of a small number of officer and NCO pilots. Most pilots and all non-technical ground crew spend only three years with army aviation before returning to their own units, whilst REME officers and soldiers are responsible for the servicing and repair of army aircraft. From October 1 this year soldiers are able to join the Army Air Corps, either as recruits from civilian life or by transferring from other regiments and corps of the army; a small number of officer pilots

will be recruited each year from the Royal Military Academy Sandhurst. Both groundcrew and aircrew employments will be open to soldiers. The former includes driving, radio operating and clerical duties, whilst aircrew fly as observers, air gunners in anti-tank helicopters and pilots. Opportunities also exist for groundcrew to become aircrew.

Within the next few years Army Air Corps officers and soldiers will be filling all non-technical groundcrew posts and two-thirds of the aircrew posts. REME will continue to be responsible for aircraft servicing and repairs. This more permanent structure will allow the Army Air Corps to develop and retain a far greater level of expertise than hitherto.

Middle Wallop, the first true home of Army Aviation, is appropriately placed on Salisbury Plain, where so much of the pioneering of British Army flying was done. Even as an RAF station it was long associated with army flying, being the home of the Light Aircraft School for nearly ten years, and before that in 1942 being used by the 67 Tactical Reconnaissance Group of the 9th Air Force, USAAF.

The centre includes Headquarters Army Air Corps, the Flying Wing and 70 Field Workshop (Aircraft) REME. Headquarters Army Air Corps, commanded by Brigadier M. W. Sutcliffe, OBE, is the focal point for the Army Air Corps worldwide and is responsible for the maintenance of flying standards and for the technical supervision and direction of aircraft servicing wherever there are Army Air Corps units. Flying Wing is responsible for the training of all Army pilots. The Aircraft Engineering Training Wing is responsible for the training of REME servicing personnel. 70 Field Workshop (Aircraft) provide second line and third line servicing facilities for the Centre and UK.

Under Headquarters Army Air Corps there is the Demonstration and Trials Squadron which carries out evaluation trials of new aircraft and ancillary equipment. The Army's new Gazelle, is undergoing intensive flying trials in this squadron before entering service with the Army Air Corps in 1974.

Early in 1970 the Directorate of Army Aviation moved to Middle Wallop from the Ministry of Defence. The present Director is Major General T. A. Richardson, MBE, and his headquarters is sited in the old officers' mess northwest of the A343.

New equipment, Gazelle and Lynx, and a new status within the Army, will assist the rapid expansion of the Air Corps in the second half of the 70s to meet the steadily increasing tasks allotted to it.

Northern Aircraft Preservation Society

So rapid has been the development of aviation that material is frequently destroyed before its historical significance has been appreciated. Yet relics a mere 60 years old are already near-priceless. Only in the last decade has the realisation spread of the need to preserve this

heritage. The NAPS grew around a 1928 Avro Avian, which was "adopted" in 1962 as a wreck worthy of restoration. Since then a number of aircraft have been acquired, together with engines and other ancillaries. Work continues to rebuild these to exhibition condition, and to secure additional items. It is hoped one day to see a regional aviation museum built, but until such time, aircraft are placed in other suitable museums on extended loan. In this way the work of the society will be seen by and will benefit a large number of people.

NAPS is anxious to welcome new members who will undertake part of the work of restoration. Enthusiasts without skills in that direction are also needed to organise "background" activities such as display planning, photography, maintenance of records, storage of equipment and magazines, model-making, etc. Especially wanted are people willing to accept the responsibility of administration of an organisation which is becoming increasingly complex. Gifts of aircraft parts, photographs, log-books, literature are always received with gratitude. Items on loan are equally welcome. Conversely, the society is prepared to make material available on a temporary basis to interested groups or individuals; requests to exhibit at local displays are met wherever possible.

Weekly meetings are held to discuss current work and future plans. Reconstruction takes place either at members' homes, in the society's Irlam and Eccles premises, or wherever else may be convenient to a group of helpers. A number of air displays and other events are attended as fund-raising and publicity exercises.

The society was responsible, in 1967, for forming the British Aircraft Preservation Council, and is affiliated to the Transport Trust and the Popular Flying Association. For those interested in membership the annual subscription is £3, or £2 for members under 18. This entitles you to receive the magazine *Control Column* with NAPS supplement each month, and to take part in all society activities. Membership enquiries should be addressed to Mrs Olive M. Robinson, 25 Cromwell Grove, Manchester M19 3QD and offers of material and general correspondence to the hon chairman, Mr Peter Schofield, 8 Greenfield Avenue, Urmston, Manchester, M31 1XN.

Service news

The production/conversion line of Victor K2s is now well under way at Hawker Siddeley's Woodford factory. In addition to the prototype, XL231, already flying, there are XL189 (2), XL191 (3), XL192 (4), XL163 (5), XL190 (6), XL513 (7), XM715 (8), XL511 (9), XL160 (10), XL188 (11), XL512 (12), XL158 (13). Ultimately the remaining Victors will be withdrawn from SR duties, their role being taken over by modified Vulcans. Work on the latter will take place at HSA's Bitteswell works.



Bulldog T1s now in service with 2FTS at Church Fenton have been coded in sequence from (1) XX519, including XX522 (4). It is reported that the CFS will operate its Jetstreams from Shawbury when the first aircraft are delivered in the autumn, and 5FTS, the advanced pilot training unit, will move from Oakington to Finningley with the new type.

Leconfield, currently the operating base for the Binbrook Lightning wing while the runways are reconstructed at the Lincolnshire base, has been host to the Lightning F6s of 56 Sqn from Akrotiri, Cyprus. In addition to ten F6s, including XS928 (E) and XS919 (R), the squadron also operated target Canberra B2 WJ681, finished in the latest matt camouflage, red/blue roundels, with a mini red and yellow phoenix on the fin. Also moved in to Leconfield is the Target Facilities Flight with Lightning F1As XM173, XM181 and XM183. Leconfield is the home of 60MU which overhauls Lightnings for the RAF's squadrons in the UK and Germany.

The Open Day held at the RAE Farnborough in June gave an opportunity to see some of the aircraft in use at this airfield and other RAE establishments including Comet 4C (modified, with Nimrod-type fin) XV814, Meteor T7 XF274, Hunter T7 XL563, Lightning T4 XM967, Sea Vixen FAW2 XS577,

Shackleton T4 VP293, Canberra B6 WT212, Hastings C2 WD480, Devon C2 XG496, Scout AH1 XP166, Gazelle XW276, Wessex HAS1 XL728, Buccaneer S1 XN926 (from West Freugh) and BAC One-Eleven XX105 from Bedford. Other aircraft present on the airfield, some in a distinctly non-airworthy condition, were Meteor T7 WL405, Provost T1 XF844, Scout AH1 XP165, Comet 4 XV144, Comet 2 XN453, Shackleton MR3 WR972, Hastings C2 WJ327, Scimitar F1 XD219, Sea Vixen FAW2s XJ580, XN649, XN652 and XS524.

Finally, some brief items for the record. The Waddington Vulcan wing has temporarily moved to Fairford, Glos, while runways are re-surfaced. The former RN Aircraft Yard at Sydenham was formally handed over to the RAF at the beginning of July. The prototype Phantoms, YF-4Ks XT595 and XT596 and YF-4M XT853, are currently at HSA's Holme-on-Spalding Moor airfield, where all major work on this type is carried out.

On display

The Second World Helicopter Championships were held at Middle Wallop, Hants, during the last week in July. Sponsored by the Helicopter Club of Great Britain, they attracted an

interesting range of competitors, the stars of which were the four teams from Russia. On the military side there were entries from our own navy with a Wessex HAS1 from Portland, the RAF with a Whirlwind HAR10 from Ternhill and the Army with an Alouette and two Sioux AH1s from Middle Wallop; the Austrian Air Force with three Alouette IIIs from 1 Wing, 2 Sqn, 1 Regt (**photo 1**); the German Air Force with an Agusta-Bell 47G III from FFS-S at Fassberg; and the German Army with an Alouette II from Bucheburg. On the civil side all the competitors flew British-registered helicopters which included Jet Rangers, Brantly B2B, Hughes 300 and 500, Bell 47G, Enstrom F-28A and Skeeter.

The competition, which was designed to test the skill of the crews in flight planning, navigation, precision manoeuvres and exercises to demonstrate their expertise in handling their helicopter in all phases of its flight capabilities, was decisively won by the Russian team of Chekalov and Kapralov. Flying one of the three Mil Mi-1s (**photo 2**) brought over for the contest, they scored 847 points, with the runners up being the RAF's CFS team with 828 points and the Austrian Air Force team with 822.

Following the championships the Army Air Corps presented its bi-annual Air

Days (27-28 July). As well as flypasts from the competitors an international element was maintained by the *Blue Bees*, the Belgian Army helicopter display team from the 17th LA Squadron based at Werl in West Germany, flying Alouette IIs. Newcomers were presented in the form of Gazelle AH1s from the IHTU and a Lynx from Westland at Yeovil. Needless to say the Army was represented by the *Blue Eagles* and the ubiquitous Skeeter. Sadly on this Army occasion main support for the programme came from the RAF and good as it was from a spectator point of view it does not measure up to the superb set-piece battle displays put on by the Air Corps Centre in the past. We look forward to the Army really flying at its own display in 1975.

The RAFA display at Gaydon on July 28 was a very disappointing event. No effort was made by the organisers to give the large Midlands crowd attending more than the minimum entertainment either on the ground or in the air. The only aircraft parked near to the public enclosure was the *Falcons'* Hercules, while the flying display, marred by bad weather and a failure of the air traffic control system, had only routine items, the only exceptions being a splendid Harrier display (from 233 OCU) and the Rothmans team with their Pitts S2As.

The air races and display held at Shobdon, Herefordshire, on July 22 were again a well planned and interesting event. The Formula One races with six laps of a very close circuit attracted the usual Cassuttis, Betas and Cosmic Wind, with the addition of a third Cosmic Wind to the scene, R. S. Voice's G-BAER (photo 3). The pylon turns by the skilled race pilots produced an exciting spectacle for the large crowd. The main event, the Strongbow Trophy air race, over a conventional long distance circuit, brought in some 30 competitors, ranging from Turbulents through to Ron Paine in the Hawk Speed six G-ADGP and a couple of "hot" Cessna 310s. In an exciting finish the Bonanza G-ARZN pulled through to first place by default of two earlier finishers who had turned on the wrong aerodrome pylon, right in front of the judges. The flying display was well supported by the RAF and visiting light aircraft produced some colour to the occasion, not least Messenger RG333 (G-AIEK) painted as Lord Montgomery's wartime field aircraft (photo 4).

The latter machine also appeared in the static park at the International Air Display held at St Mawgan on August 8. Taking over from the highly successful Chivenor show, this Cornish display lived up to its forerunner with participation by the French Navy, Canadian Armed Forces, Belgian and Danish Air Force in the flying programme and additional aircraft from the Dutch Navy, USN and German Air Force in a large static park. Of particular interest was the maritime aircraft group which comprised an Orion (USN), Neptune (R Neth Navy), Atlantic (R Neth Navy), CL28 Argus

(CAF) and our own Nimrod. The star appearance came for the third year running from the R Danish AF. In 1971 the St Mawgan Battle of Britain display featured A-35 Drakens of 725 Sqn, in 1972 the first S-35 Drakens of 729 Sqn (the FR version) and this year a two-seat Sk-35 Draken trainer, also from 729 Sqn.

The CAF CF-104 Starfighters in the flying display were the first to appear in the UK with the new style national insignia and bilingual titling either side of the roundel. A well balanced programme included the welcome appearance of Canberra B2s and a TT18 from the resident 7 Sqn. It's a pity that Strike Command has not permitted an aerobatic routine to be worked up by one of the Canberra units; the memories of 231 OCU's aircraft being manoeuvred through a full sequence without leaving the airfield boundaries, still live on. The *Red Arrows* again gave a sparkling performance as did the Belgian *Slivers* F-104s and were well supported by the RAF's vintage aircraft, and a good range of front-line types. Returning to the static display, the organisers are to be commended in bringing down to the south-west such a variety of types—Hastings, Argosy, Buccaneer, Sioux, Beaver, Puma, Vulcan and Hunter included, and as a final tribute to Chivenor giving the final display slot to a flypast by 12 Hunters from 229 OCU and an aerobatic display by a Hunter F6 from this unit.

Another RAF display was held at Valley, Anglesey, on August 11. Home of 4 FTS (Gnats and Hunters) it naturally featured the resident aircraft. Surprise items came from RAF Germany in the shape of a Harrier GR1A from 3 Sqn and a Lightning F2A of 92 Sqn. The USAF Open Day at Lakenheath on August 18 was also well supported by RAF Lightnings with F3s from 111 Sqn (XR713-A), 5 Sqn (XR749-Q) and 226 OCU (XP737). Overseas participation came from the *Patrouille de France*, the Belgian Air Force's *Diablos Rouges*, 421 Sqn Canadian Armed Forces, the German Air Force (G-91s and F-104Gs) and for the second time in a month a SR-35XD Draken (AF-153) from 729 Sqn, RDAF. American service aircraft present included C-141, F-4D, O-2A, P-3A, C-1A, UH-1H and C-130.

October diary

With the display season now coming to an end there are just two autumn events notified at present, open to the public—on October 14 the Imperial War Museum is holding a Vintage Air Display at Duxford, Cambs, and on October 28 the Shuttleworth Trust will have its "end of season" flying day at Old Warden, Beds.

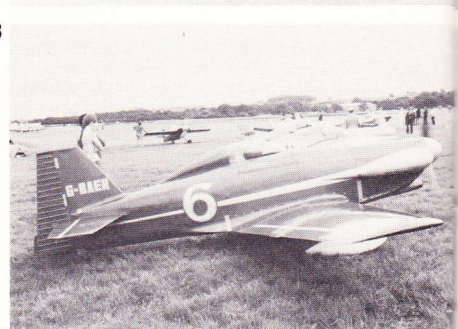
A non-public event is the ROC display being held at Ternhill, Salop, on October 7.

For some of this month's contributions we are indebted to Messrs. P. J. Bish, D. Conway, P. Cuniffe, A. J. Cunningham, J. Guthrie, G. D. Herbert, R. Levy, N. P. Macknight, G. M. Nason,

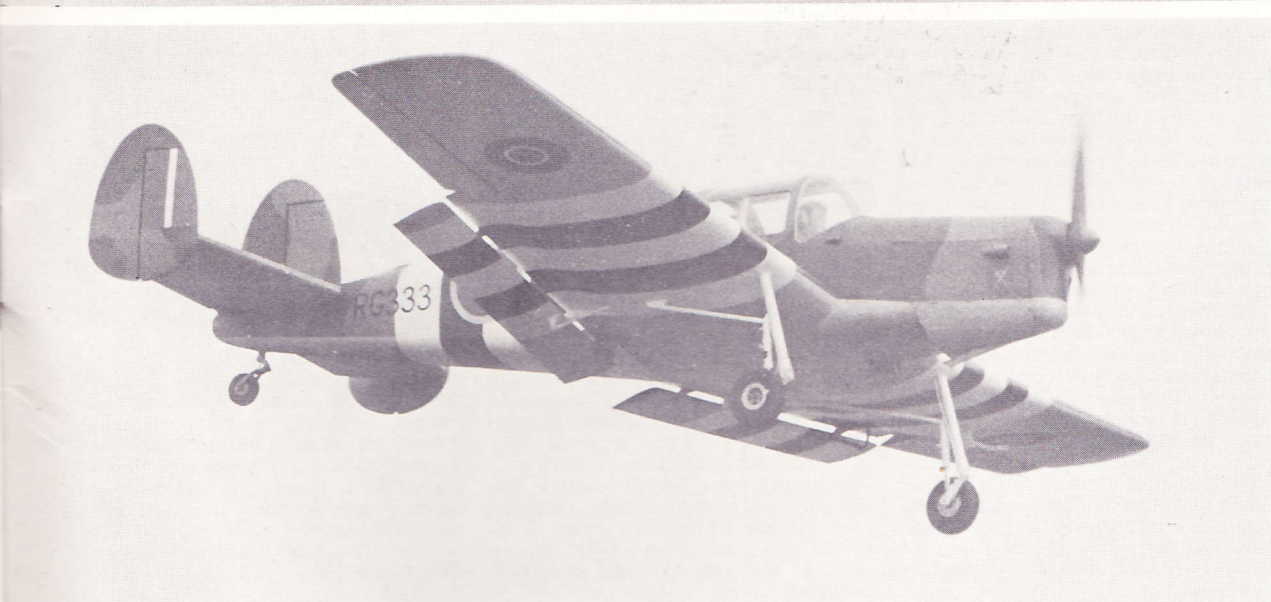
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S. G. Richards, E. A. Shackleton, D. Spurgeon, A. J. Wright and R. Wright. Also the publications "Air-strip", "Anglia Aeronews", "Blackbush Aviation Review", "Circuit 73", "Flypast", "Hawkeye", "Scottish Air News", "Skyward", "South East Air Review", "Tristar" and "Ulster Air Mail".



4

BOOKS

THE AGE OF THE AIRSHIP

By Edward Horton
Sidgwick & Jackson Ltd, 1 Tavistock
Chambers, Bloomsbury Way, London
WC1
price £2.95

Most people consider the airship to be a curious relic from the past—a strange mode of transport that was flawed in conception and doomed to failure. Even if this is true, and the colossal “liners of the sky” never appear again, the age of the airship still forms a fascinating chapter in aviation history, and in this book Edward Horton has produced the most readable and entertaining account of the airship’s life and times yet to appear. He describes in hilarious detail the trials and tribulations of the early pioneers of the airship, including those of Santos Dumont, and chronicles the extraordinary exploits of Zeppelin and Eckener. There are chapters on airships in the First World War, on the marathon trips over the oceans and the poles in the twenties and thirties, and on the hideous disasters which put paid to the great age of the airship. The photographs are outstandingly good and some of them are nothing less than remarkable; full marks to Mr Horton’s picture researcher Annie Watt. A splendid book for airship buffs and fully deserving a place on the shelves of public libraries.—P.J.R.M.

HISTORIC AIRSHIPS

By Peter W. Brooks
Hugh Evelyn Ltd, 9 Fitzroy Square,
London W1P 5AH
price £5.00

Coffee table-style book of large format and, although seemingly thin, jam-packed with facts and figures on every type of historic airship one could wish for. This book analyses the evolution particularly of the rigid airship and discusses the reasons for its failure and for its final eclipse by the aeroplane. The narrative has all the signs of being as thoroughly researched as anyone could hope for—the bibliography, in fact runs to well over a page of titles—and there are highly detailed appendices providing such material as operating statistics, designations, and manufacturing data—even down to development time, chief designer’s names, direct design and construction man hours, cost when built and at 1972 values, etc. Complementing all this are sixteen beautifully reproduced full-colour profiles of representative types, from the Giffard steam dirigible of 1852 to the Zeppelin LZ129 *Hindenburg* of 1936. This book also contains many excellent half-tone illustrations and line drawings and can be regarded as a truly definitive work.—P.J.R.M.

NORTH AMERICAN: An Aircraft Album

By Gordon Swanborough
Ian Allan Ltd, Terminal House, Shep-
perton, TW17 8AS
price £2.75

Everyone likes the P-51 Mustang—or so it seems from the number of books on the type that continue to appear—but perhaps this highly commendable book by Gordon Swanborough will result in many other North American planes gaining a share of admirers, too. Principally a producer of military aircraft during its past 40 years, North American’s output has covered everything from primary trainers to supersonic fighters and, maintaining a lead in advanced technology, it has gone on to exotic research aircraft like the X-15 and the B-70 and is today building the free world’s most advanced strategic bomber, the swing-wing B-1. The whole range of types produced by NA is covered in this 128-page book and, to get back to the Mustang, there are no less than 30 pictures of this particular type, including some rare shots of evaluation trials aircraft on test from A and AEE, Boscombe Down. Rounding off the work is a type and production list providing information on North American Charge [Type] Numbers allocated from 1935 to 1967 and a few more recent numbers available for publication.—P.J.R.M.

PICTORIAL HISTORY OF THE MEDITERRANEAN AIR WAR, Vol 2

By Christopher F. Shores
Ian Allan Ltd, Terminal House, Shep-
perton, TW17 8AS
price £3.00 (p&g 30p VAT inclusive)

This work covers the period from just before the assault on Pantellaria and Lampedusa in June 1943 to the end of the war and is basically an account of the exercise of air power in support of armies on the ground with an air superiority already won, and of the maintenance and improvement of this support despite a decline in strength of the forces available as the calls of other, more important areas took their toll. Something of a sideshow to the main course of the campaign was the RAF’s own “private war” over the Aegean fought by Eastern Air Command, and the adventure of these operations is told in some detail, opening up a fascinating but little known aspect of the air war. The birth and growth of the Balkan Air Force is also traced. The narrative is complemented by a 96-page photo section containing many hitherto unpublished pictures from the files of the Imperial War Museum and elsewhere, including a high proportion of SAAF subjects. The captions are mines of information in themselves and Mr Shores deserves the thanks of all enthusiasts for producing what is altogether a most absorbing book.—P.J.R.M.

HISTORY OF AVIATION

Edited by John W. R. Taylor and Kenneth Munson
New English Library, Barnards Inn,
Holborn, London EC1N 2JR
price £10.50 (UK only)

For those who can afford to lay out £10.50 for a single book, this sumptuous tome is very good value, for it provides the pick of the material from the original, much longer (72 part) *History of Aviation* and, what’s more, presents it on really good glossy paper which gives the illustrations a sparkle they previously lacked. Every aspect of human flight is recorded in 500 pages of highly-factual narrative and pictures (mostly in colour) contributed by a multitude of international writers, photographers, and artists—many of them pilots, aircraft designers and technicians. All told there are 113 separate feature articles in this book and there is certainly something for everybody, whatever their tastes in aviation literature. The beautifully-reproduced pictures alone are well worth £10.50 in these days when original 8in by 6in prints cost 30p or more each and this book can be unreservedly recommended to anyone seeking a really good insight into aviation both past and present.—P.J.R.M.

HISTORY OF AVIATION AIRCRAFT IDENTIFICATION GUIDE

Edited by John W. R. Taylor and Kenneth Munson
New English Library, Barnards Inn,
Holborn, London EC1N 2JR
price £3.95 (UK only)

This work, designed as a ready-reference guide to significant aircraft old and new, from the Montgolfier hot-air balloon of 1783 to the Grumman Tomcat and McDonnell Douglas F-15 Eagle, covers 270 types of all nationalities. Each type is briefly described and illustrated by one photograph, or, in a few cases, a drawing, plus multi-view silhouettes and the book is fully indexed.—P.J.R.M.

FAMOUS MARITIME SQUADRONS OF THE RAF, Vol 1

By James J. Halley
Hylton Lacy Publishers, Coburg House,
Sheet Street, Windsor, Berks.
price £3.25

Second of the author’s books on RAF squadrons in this landscape-format series, this work deals with Nos 22, 201, 202, 204 and 206 Squadrons and includes historical narratives, lists of bases, aircraft and COs, half-tone illustrations and colour plates of unit badges, Standards and representative aircraft, the latter in profile. Researched from Squadron Operations Record Books (RAF Forms 540 and 541) and other prime sources, these histories make fascinating reading and will be of great interest to ex-squadron members, enthusiasts and modellers alike.—P.J.R.M.

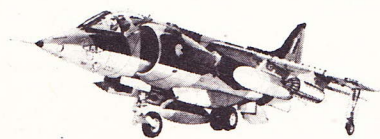
The scene: New York, May 1969.
The event: The Daily Mail Transatlantic Air Race.

A small, stub-winged jet fighter swoops in from the sea and heads for Manhattan. As it nears the cluster of Skyscraper blocks it begins to slow down... slower and slower, until it's hardly moving at all. It hangs, incredibly, way above the ground, engines whining, dwarfed by gigantic buildings. Then, to the astonishment of watching Americans, it slowly descends to the ground. Hawker-Siddeley's Harrier - first operational VTOL combat aircraft in the world - has arrived.

The pilot, Squadron Leader Lecky-Thompson RAF, won first prize for the fastest overall London to New York time... just 6 hours 11 minutes 57 seconds!

The starting point was London's GPO Tower - so Lecky-Thompson hopped into his Harrier in a disused coalyard at nearby St. Pancras station. The finish was at the Empire State Building in New York - just one minute away from the pier on which he landed! 50 years after Alcock and Brown's first Transatlantic flight, Lecky-Thompson made history with a "Jump Jet".

Back in the middle fifties, Harrier, then designated the P.1127, was a private development by the Hawker-Siddeley and Bristol Engine companies. And, in common with many other highly regarded aircraft produced in Britain since the war, spent its formative years being jeered at by politicians and Air Staff. Eventually, two prototypes were ordered, and on October 1st 1961, the first 'hovering' flight was made - at a tightly tethered 18 inches off the ground



altitude! A further four prototypes were made for the Ministry of Supply and on September 12th 1961, the P.1127 demonstrated the swivel-nozzle transition from vertical to forward flight.

Now the project was gathering momentum and nine more P.1127's were built in 1964 for Service evaluation and were called Kestrels. These became known as the 'Tripartite Nine' as they were tested by a combined team from the RAF, US Army & Navy and Luftwaffe. By 1969, the P.1127 had become a production aircraft Hawker-Siddeley and named the Harrier.

The Harrier of up to around Mach 1, yet can land in an area no larger than a tennis court. It carries a variety of under-wing rocket batteries and tanks and napalm service with the Marine Corps.

can fly at speeds Mach 1, yet can land in an area no larger than a tennis court. It carries a variety of under-wing rocket batteries and tanks and napalm service with the Marine Corps.

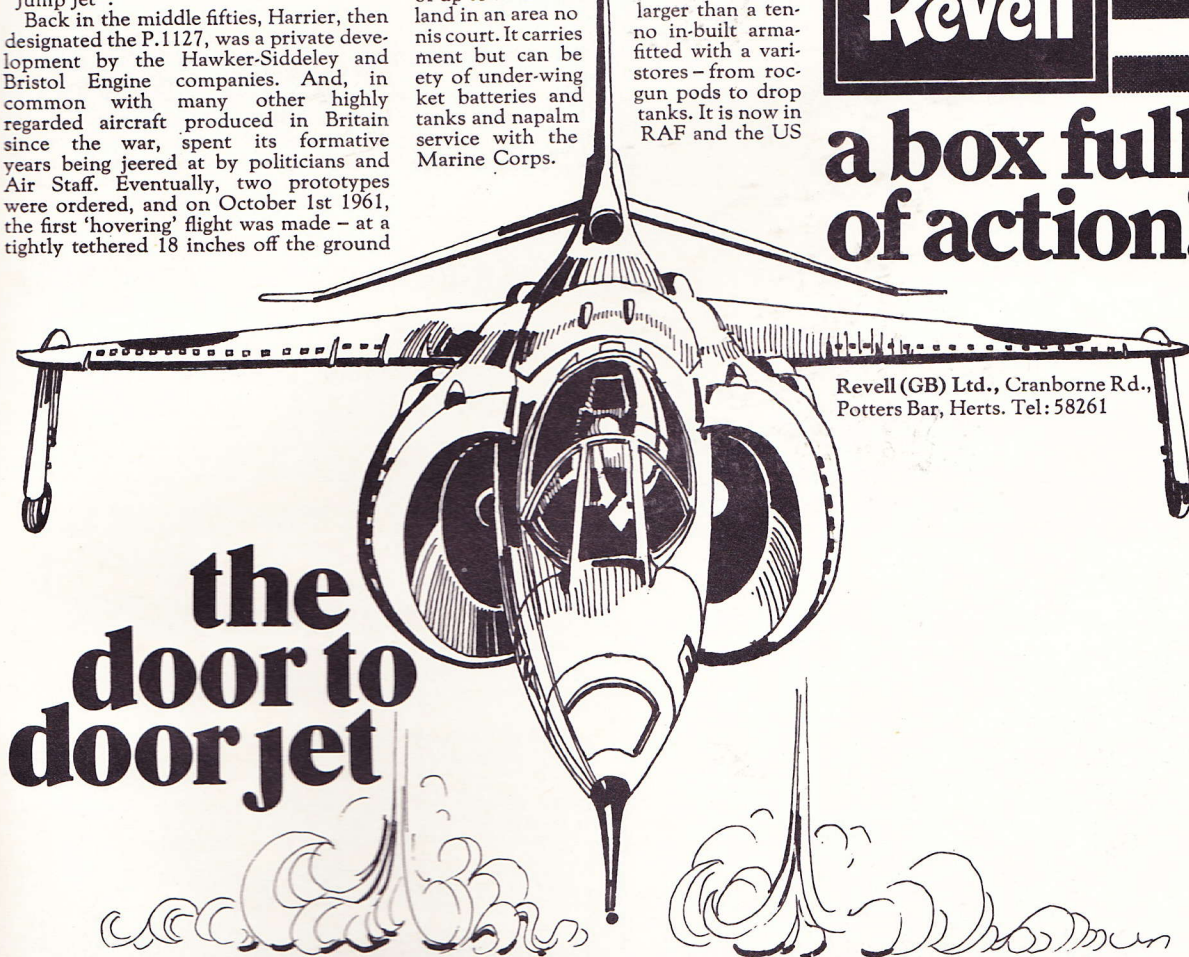
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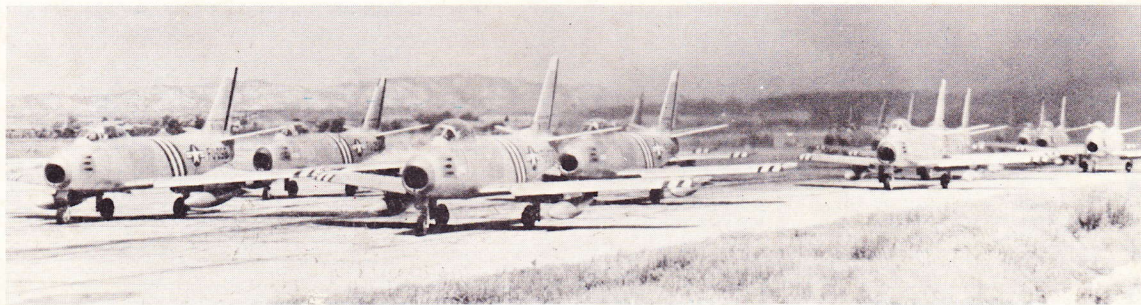
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